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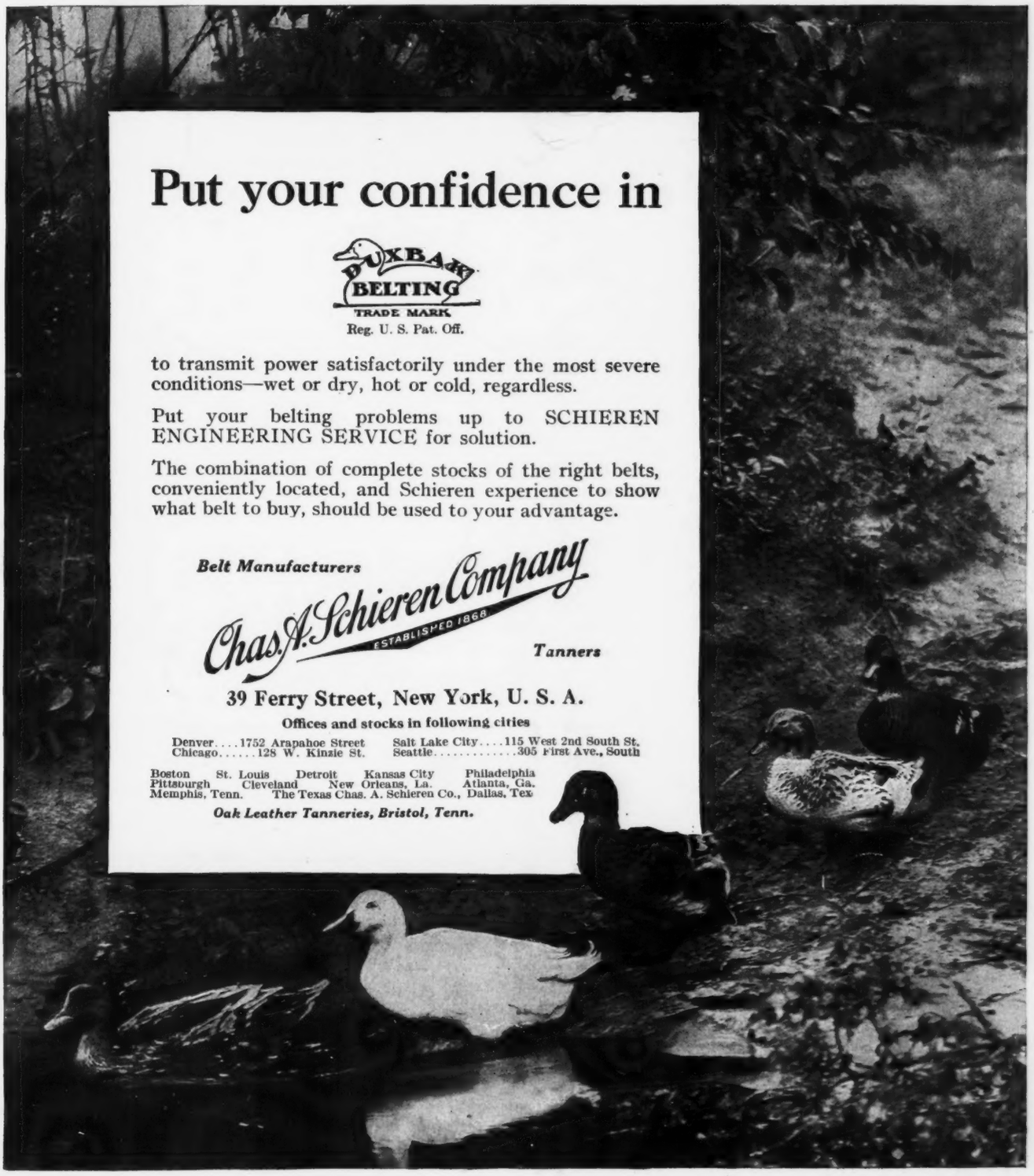
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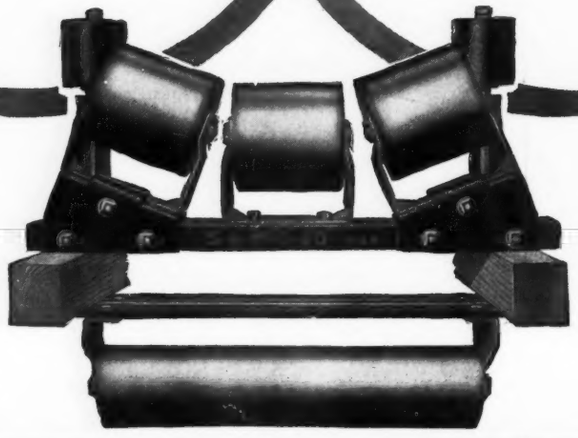

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Engineering and Mining Journal

VOLUME 104 JULY 7, 1917 NUMBER 1

Growth of the Talc Industry

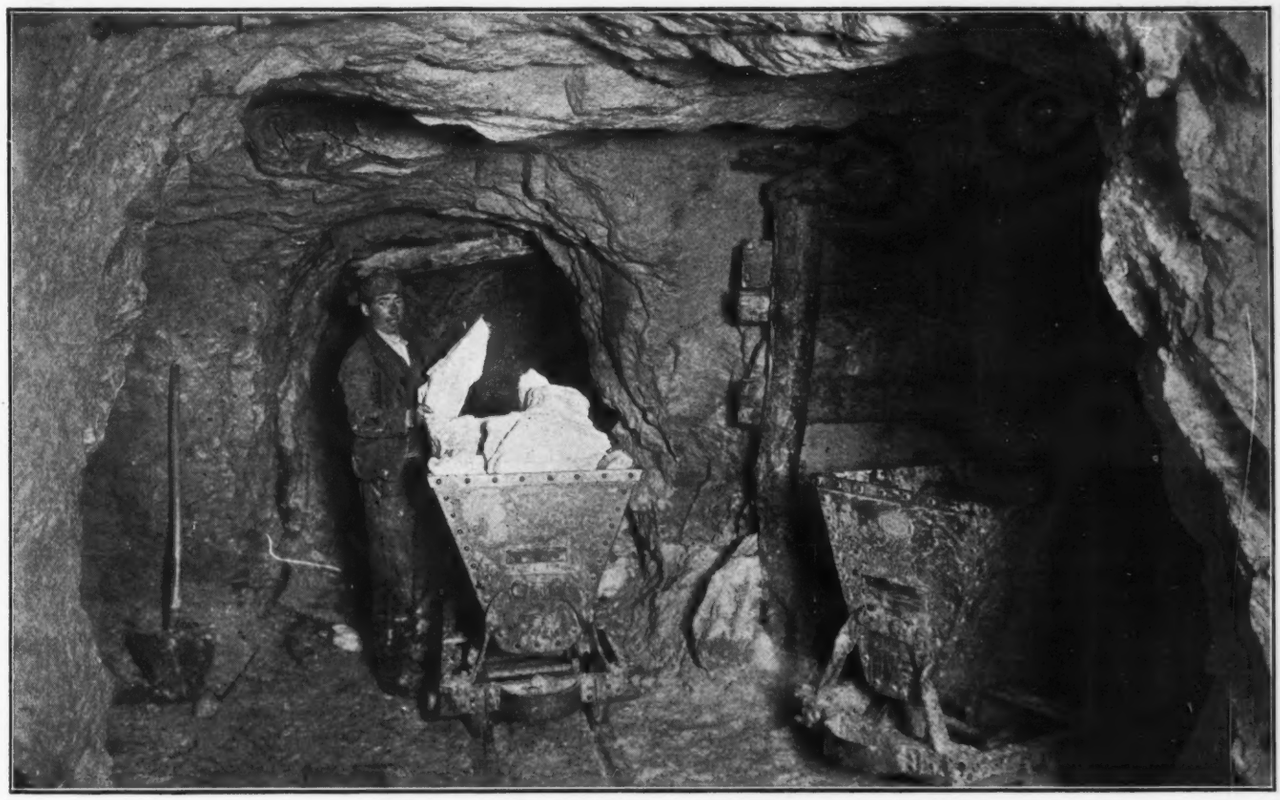
By FREELAND JEWETT
President, Eastern Talc Co., Boston, Mass.

Production of talc in Vermont has, during the last ten years, increased from 10,000 tons per annum to 70,000 tons, which is equal to the combined production of France and Italy. A brief history of the talc mining and grinding industry in general is given.

THE history of the talc industry of Vermont for the period covered by the last 11 years has been to such an extent influenced by the operations of the Eastern Talc Co. and the mining and manufacturing so extensively developed by this corporation, that in treating of the subject some activities are mentioned in detail. These details are considered interesting since they represent the most comprehensive development in talc properties ever accomplished either abroad or in this country.

The increase in the talc production of Vermont during the last ten years has been marked. While in 1906 the talc, in 1915 the amount had risen to 62,000 tons, and in total output of the state was 10,413 tons of pulverized complete figures for 1916 show an approximate production of 70,000 tons.

Prior to 1907 there had been three or four small producers, some of which had no mills and shipped to various grinding plants, while others produced in an irregular fashion, often being forced to cease operations in extreme weather. The majority of the companies operating were poorly financed, and the mining end was crude, being usually in the hands of men of little or no experience. Prices were often dictated by necessity for funds or enforced by shortage of storage space for finished product; transportation was undeveloped in many cases, and in general the industry was unprofitable and ill-managed.



UNDERGROUND IN THE TALC MINES, PEROSA, ARGENTINA, ITALY

In 1905-06 new interests started exploration work in Roxbury, developing a mine on the White River below that town and the next year taking property in East Granville, where the first mill was completed in 1907.

The capacity was 1000 tons monthly, since increased to 1200 tons. These same interests by 1911 had holdings in Braintree, Bethel, Stockbridge and Rochester, and by 1913 had three mills at work with a capacity of 4800 tons per month—a larger tonnage than produced in all France and more than double the entire production of Italy.

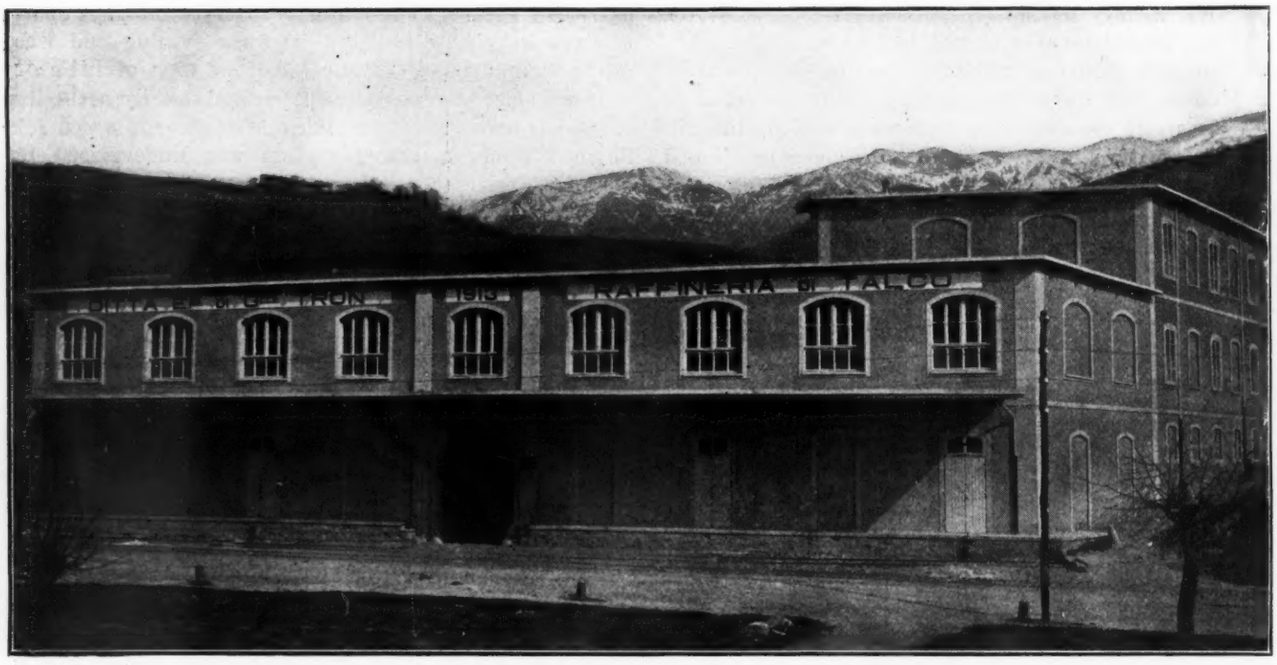
The greatest increase in consumption has come from the paper-manufacturing trade and the manufacturers of prepared roofings, while rubber and the textiles have also developed their requirements in enormous proportion.

The Eastern Talc Co. produces a large proportion of the total output of Vermont and Massachusetts, having in operation at Rochester, Vt., the largest talc mill in the world. The construction is up to date, and the buildings are sprinkled by approved underwriters' system. The company operates also one other mill of 1200 tons' monthly capacity, which has already been noted. The mines at Rochester are connected with the mills by about five miles of railroad built by the company nine miles—so that an increase in production would seem to depend on better transportation.

It would appear that the greater proportion of the well-located talc deposits in Vermont are now being actively worked or held in reserve by operating companies and that increase of production will probably come from producers already in the field. Some deposits are known to exist that would justify development could transportation be secured, these mainly in the southern central portion of the state, but the possibility of railroad building in this section is remote if indeed it is considered at all.

Foreign Production of Talc

The foreign production of talc has shown great increase from 1905 to 1913 inclusive. In that period the output of the French properties has practically doubled, in the latter date being in the neighborhood of 60,000 tons per annum, although a small proportion of this production was soapstone and asbestos. The Italian production has been wholly talc, and, from 7000 tons



TALC MILL AT PEROSA, ARGENTINA, ITALY

in 1913. The power at the mills is wholly steam. The mines are operated by installations of steam and compressed air. Diamond drilling has been extensively done on most of the reserve properties, and a tonnage of over 2,800,000 has been proven. At East Granville the ore is transported to the mill by an overhead cableway.

C. B. Hollis has had charge of the work for the last 10 years. The property is the most complete and extensive talc mine in the history of the industry as viewed by comparison with the French mines in the Pyrenees and the Italian mines in the Alps above Turin.

Other properties operating in Vermont are at Chester, Johnson and Waterbury, with from about 9000 to 12,000 tons average production per year each. Two of these mines are subject to a long haul to mill—in one case

per annum in 1905, has increased to approximately 18,000 tons.

The main producing factors in France are two properties, one at Montferrier, in the Pyrenees, about 12 miles from the Spanish line. This represents a large investment, in all estimated at upward of four million francs. The ore is transported by a tramway for about three miles to a mill with a capacity of over 100 tons per day. An excellent water power has been developed—in fact there is a large surplus of power at all seasons of the year. The water comes from above the snow line and in one place shows a continuous drop, within a distance of approximately a mile and a quarter, of 1000 ft. On account of the high altitude at which this property lies, it has been found practical to conduct mining operations in general only from June until November, the great trouble being caused by crude talc freezing in the

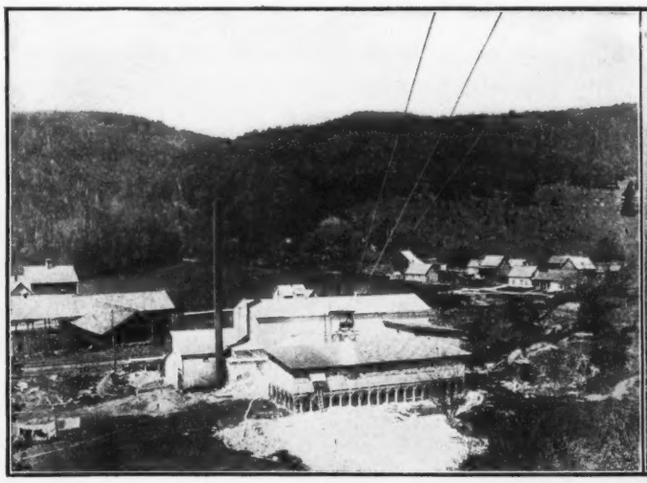
tramway buckets, making it impossible to discharge them.

The process of manufacture is practically the same as in the United States with the exception that the grinding units are smaller and the pulverized material is forced through the bolting cloths by the action of a fan running at high speed. The transportation problem is not wholly satisfactory, and even at the low rate of wages prevailing before the war, it has been impossible for this company to make satisfactory earnings.

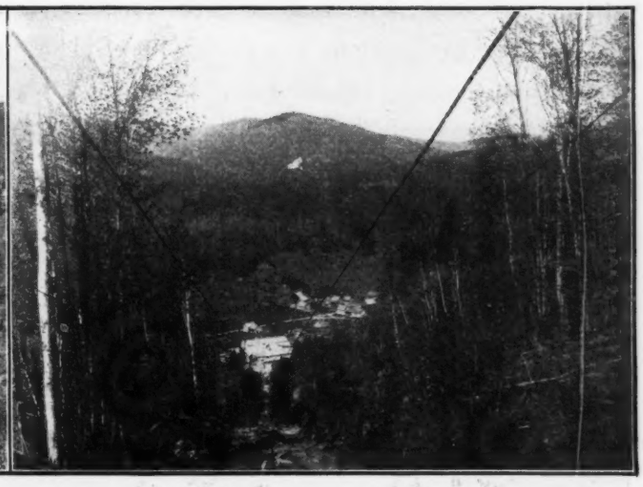
The other large French property is at Luzenac, nearer the port of Cette, and is worked with greater success from a financial standpoint. During 1913 the operations were extensive and were reported to be reasonably profitable. The transportation and shipping facilities are considered the best in France. At present, on account of war conditions, the French production is practically negligible.

The Italian production comes mainly from the section above Turin in the neighborhood of Perosa, Argentina, in the Valle di Chisone. There are several small properties worked largely by interests from Turin and Livorno and one considerable series of properties worked by a local proprietor who resides in Perosa. The production comes from several mines or caves, as they are locally called, the output from no single property being extensive. The transportation from some of the mines is by tramway for a portion of the distance, and from some other small properties is by wagon. The mill supplied from these various properties is of modern construction, electrically driven by a well-developed water power.

The process is analogous to that employed in the United States except that prior to crushing, much of the material is hand-picked, some of the ore being reduced to the size of a goose egg by hand hammering or chipping. This work is done by women, who operate with a modified form of geological hammer. Even at the low wages prevailing prior to the war (about two lira a day for women, equivalent to approximately 40c.) the production costs have been high, approximating double those of the French production; in fact, the French producers possess the advantage in cost over the Italian producers in three main divisions—mining, transportation and milling. The greater comparative value of the Italian product, however, has made competition possible and, as a matter of fact, in general the production of talc in Italy has been more profitable than in France. The uses of talc in industry are so well known that it seems hardly necessary to outline them in an article of this kind.



EASTERN TALC CO.S MILL, EAST GRANVILLE, VERMONT



LOOKING DOWN TRAMWAY EAST GRANVILLE TALC CO.

Graphite in Madagascar*

Ceylon is the world's greatest producer of graphite, used in the manufacture of crucibles. Madagascar, since the outbreak of the war, has been producing an amount almost equal to that of Ceylon. Before the war the Singalese output was ample for the world's needs, averaging approximately 31,000 metric tons per annum. The production has been governed entirely by the market price, the mines having been operated or closed down as the demand rose or fell.

Madagascar has now become a competitor, the product in the last nine years having been as follows: 1907, 8 tons; 1908, 82; 1909, 197; 1910, 545; 1911, 1246; 1912, 2731; 1913, 6313; 1914, 7939; 1915, 12,188 tons. In less than eight years the production has increased from eight to over 12,000 tons per annum and at present (October, 1916) is about 2000 tons per month, and it is estimated that during 1917 it will reach 16,000 to 20,000 tons, or two-thirds of the output of Ceylon, without reaching its limit.

After the war is over and the demand for graphite returns to normal, there will be an abundance of material provided the prices are such that both fields can afford to operate. Operators are already becoming uneasy, fearing an oversupply and a corresponding cut in prices.

At the present time (October, 1916), there is a great variation in prices, the quotations being: Madagascar, 1000 to 1200 fr. ($200 to $240) per metric ton at Marseilles; Ceylon, 2080 fr. ($416) per 1016 kg. f.o.b. Colombo.

The lowest price quoted is 924 fr. ($185), the highest 3235 fr. ($647) per ton.

*Abstract of an article in "Le Grande Livre," Paris, Oct. 15, 1916.

Copper Smelting at Santa Lucia

By FRANCIS CHURCH LINCOLN
Director, Mackay School of Mines, University of Nevada, Reno, Nev.

Description of a small smeltery in an out-of-the-way place, with interesting costs of operation and general data, especially on fuels. Comparisons are made on transportation conditions and metal markets prevailing before and since the beginning of the war.

THE Southern Railway of Peru, running from Mollendo on the Pacific Ocean over the Western Range of the Andes to Puno on Lake Titicaca, crosses the divide at Crucero Alto, which is 224 miles from Mollendo and 14,688 ft. high. Thirty-one miles beyond this summit and 13,250 ft. above sea level is Santa Lucia, where the copper smeltery of the Lampa Mining Co., Ltd., is situated. This little smeltery—operating under the handicaps of high altitude, expensive fuel and distant market—presents many points of interest, some of which will be described in these notes.

Equipment of the Lampa Property

The Lampa property is managed by E. C. P. Barber, who has direct charge of the smeltery. Practically all the ores treated come from neighboring mines belonging to the company and under the superintendence of J. V. Turner. The furnace is an Allis-Chalmers 36-in., round, copper blast furnace. Air is supplied by a 16-cu.ft. Baker rotary blower driven by steam produced by llama dung, locally known as *taquia*. It costs $2.50 per ton, and four tons is consumed in 24 hours. It may be stored outdoors without protection as only the outer layer becomes wet when it rains. A dust chamber has been constructed in the rock behind the smeltery, where flue dust to the extent of 10% of the charge is collected. This dust contains 1.5% copper and 7 oz. silver. It is wet down and returned to the blast furnace without briquetting. The plant is also equipped with a Robey square lead blast furnace, which is rarely used.

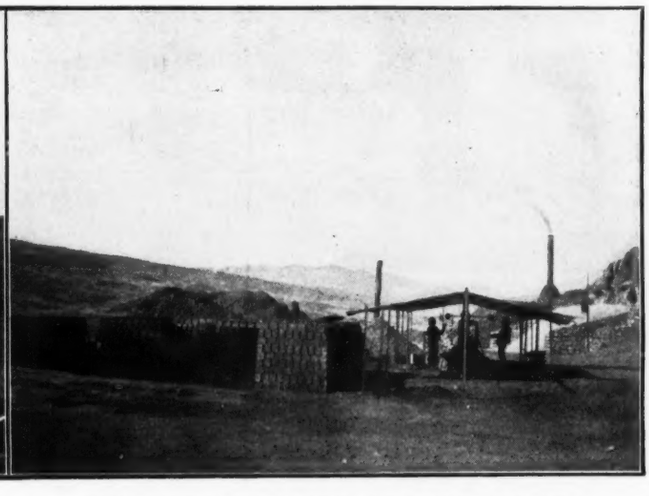
The Lampa smeltery began operations on Jan. 4, 1914, and up to June 27, 1916, had been in blast 58% of the time. Sixteen campaigns, ranging in length from 8 to 72 days and averaging 33 days, had been run and 19,377 tons of ore, flux and furnace returns smelted with the aid of 2021 tons of fuel. The following table shows the proportions of the different materials charged:

	Average of All Campaigns	Sixteenth Campaign
Ores	58.9%	55.1%
Fluxes	16.9	16.4
Furnace returns	14.7	17.8
Fuel	9.5	10.7
	100.0%	100.0%

Throughout the time of its operation the furnace has averaged 41 tons of charge per day, of which 24 tons has been ore.

The ores smelted have averaged 3.24% copper and 30.8 oz. silver per ton. When smelting first began, limestone flux was employed, but a calcareous ore is now used in its place. There is not, however, sufficient sulphur in the ores to produce the desired 40% matte, so barren pyrite is purchased and fed to the smelter. The percentage of furnace returns has been high, owing in part to experiments to determine the effect of altitude and to attempt to reduce the consumption of expensive fuel. It was found at an early date that the use of a 14-oz. blast through tuyeres an inch greater in diameter than at sea level gave satisfactory results, but the experiments with fuels are still in progress.

SANTA LUCIA SMELTERY, PERU

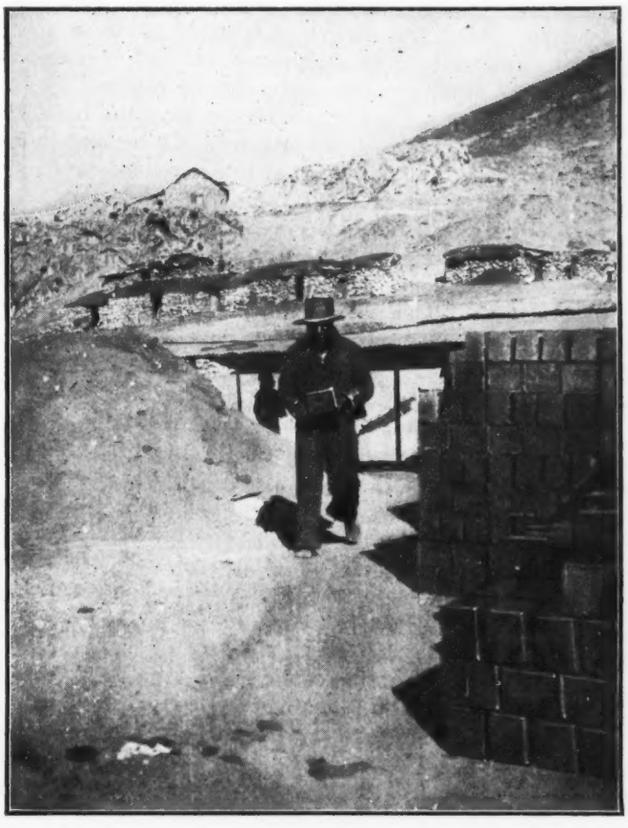


BRIQUETTES WITH SALT AND BLOOD BINDER

The cost of imported fuels has increased greatly as a result of the European War. The fuels available at Santa Lucia are imported coke, imported coal, local coal and local wood. The cost of coke delivered at the port of Mollendo has risen from $17.50 to $27.50 per ton, to which must be added $11 for railroad freight to Santa Lucia and 50c. for packing to the smeltery. American coal delivered on the west coast of South America rose from $8 to $23 in the five months prior to June 15, 1916, and is therefore nearly as expensive as coke. Anthracite from Sumbay, on the railway just west of the divide from Santa Lucia, costs $10 per ton delivered at the smeltery. The approximate analysis of

Sumbay coal shows about 60% fixed carbon, 10% volatile matter and 30% ash. This is by no means as bad as it looks, however. The ash—and incidentally the volatile matter—are mainly due to pyrite; and as pyrite is required in the charge, its presence in the coal is helpful rather than detrimental. Half the coke may be replaced by the cheaper Sumbay coal with excellent results. The combustible employed in campaign 16 consisted of 52% coke, 46% pyritiferous anthracite and 2% wood.

Wood costs $20 per ton delivered. One-third of the coke may be replaced by twice its weight in wood with satisfactory results, but at the present price of wood nothing is saved by this procedure. In making tests with wood as a fuel, it was found that its use improved the running of the furnace. At one time the quantity



STACKING BRIQUETTES, SANTA LUCIA, PERU

of wood was gradually increased until the furnace was actually run entirely on wood for ten charges. By that time the zone of fusion had risen from the tuyere level to the top of the furnace and the use of wood had to be discontinued.

A considerable quantity of fines is present in both coke and coal when delivered at the smeltery. In order to prevent this form of waste, the fines are briquetted in a hand press. The suggestion that the fines in household coal be coagulated with salt as a war-economy measure, which was made in the German and English press and also found its way into ours, was seized upon by Mr. Barber, who is now employing salt as a binder for briquetting coal. Salt costs $28 per ton delivered, and as 8 lb. of salt dissolved in 20 gal. of water is sufficient to briquette a ton of coal, the cost for binder is 11.2c. per ton. Unfortunately, coke breeze will not briquette with salt, but slaughter-house blood has been found a good and cheap binder, 20 gal. of blood with 25 gal. of water being required to briquette a ton of coke. After briquetting in the hand press, the briquettes are stacked in the sun to dry and harden.

Cost of Mining and Smelting

The furnacemen work on 12-hour shifts. The foreman receives $60 per month, the weighmen each $20 per month, the tapmen $0.90 per day, and the chargers $0.70 per day. These wages seem very low, but experiment has shown that raising wages produces bad results. Increasing the comforts of the workmen, however, produces good results, and it seems to be along this line rather than that of increased wages that improvements can be made. The cost of mining and smelting may be seen from the following table, for which campaigns 12, 14 and 16 were selected on account of their being longer than 13 and 15:

COST OF MINING AND SMELTING

	Campaign 12		Campaign 14		Campaign 16	
	Per Ton Ore	Per Ton Charge	Ore	Charge	Ore	Charge
Date	Aug. 11-Oct. 31, 1915		Jan. 5-Mar. 4, 1916		Apr. 24-June 27	
Cost of ore	$6.00	$3.33	$5.01	$2.95	$4.40	$2.43
Cost of pyrite	2.33	1.29	2.36	1.40	2.68	1.48
Cost of fuel	4.76	2.64	4.90	2.90	5.52	3.04
Wages and materials	1.65	.92	1.58	.93	2.52	1.36
General expenses	1.28	1.72	1.52	.90	2.77	1.54
Total	$16.02	$8.90	$15.37	$9.08	$17.89	$9.85

The profits made in the company store reduce these costs by about 5%.

The recoveries and losses from the smeltery reports of campaign 13, 14, 15 and 16 are as follows:

RECORD OF RECOVERIES AND LOSSES

	Copper	Silver
Matte recovery	82%	93%
Block copper recovery	1	1
Smeltery returns (bad slag, etc.)	1	1
Slag loss	10	5
Flue dust loss (by difference)	6	0
	100%	100%

The apparent absence of silver in the flue dust lost may be due to cumulative errors in the other items or to the presence of small amounts of silver in some of the ores that are not credited with any. The silver in the slag throughout these campaigns ran 1 oz., and the copper from 0.25% to 0.30%. The block copper contained 80% copper and 600 to 800 oz. silver per ton. The matte produced ran from 33% to 40.8% copper and contained from 330 to 410 oz. silver per ton.

PAYMENTS AND CHARGES ON COPPER MATTE BEFORE THE WAR AND RECENTLY, PER LONG TON

Payments	1913-1914	Mar. 31, 1916
Price of silver per ounce	£0.099	£0.1125
Ounces of silver	400	400
Value of silver	39.6	45.00
Price of copper per long ton	63	130
3½% discount	.....	4.55
	63	125.45
Refining charge	10	10.75
	53	114.70
Copper paid for—45%—1.3%	.437	.437
Payment on copper	23.161	50.124
Payment on silver	39.6	45.0
Payments on matte	62.761	95.124
Charges		
Ocean freight (42/6 and 97/6)	2.125	4.875
Broker's commission (2½% gross value)	1.569	2.378
Marine insurance (7/6 per £100)	.235	.357
War insurance (23/9 per £100)	.....	1.130
Receiving, weighing, sampling and assaying	.210	.210
Entry, dock dues and porterage	.....	.126
Charges on matte	£4.139	£9.076
Net value of matte on board ship	£58.622	£86.048

The effect of the war upon the transportation and sale of matte is well illustrated by the accompanying table, which compares the actual returns on a recent shipment with the returns that would have been made on a similar shipment the year before the war. To make the comparison more exact, the figures in each case have been given on the basis of a shipment of 20 long tons of matte containing 45% copper and 400 oz. of silver per long ton. These shipments were to England, and all figures were in English money, which for the purposes of this article are given in decimals of a pound sterling rather than in shillings and pence.

It will be observed that while the payments on copper have been reduced and the charges have more than doubled, yet owing to the higher prices of silver and copper, the net value of the matte on board ship at Mollendo is about 50% higher now than it was just before the war. The charges on matte shipped to New York are now much less than on matte shipped to Liverpool, and the last shipment made by the Lampa Mining Co. was to New York.

So successful have been the operations of the company that it is planning to increase the capacity of the Santa Lucia smeltery to 200 tons per day in the near future.

Coeur d'Alene Items, June, 1917

By Robert N. Bell
State Inspector of Mines for Idaho

The four deepest mines and principal producers of lead-silver ore in the Cœur d'Alene district are being worked at capacity with gratifying manifestations of permanency and expanding ore resources in their deepest levels, ranging down to a maximum depth of 3200 ft. vertically and including the Bunker Hill & Sullivan mine at Kellogg, the Morning mine of the Federal company at Mullan and the Hecla and Hercules at Burke, Idaho.

The high price and scarcity of labor, machinery and material are retarding the operation of new development enterprises in the Cœur d'Alene district at this time among the lead-silver prospects, but a few very interesting developments are being made that seem to hold out definite promise of new tonnage resources.

Among the zinc-ore deposits the Consolidated Interstate-Callahan mine in the Nine Mile district continues to maintain its splendid production of clean zinc ore. A new body of rich zinc mineral has recently been opened in the 1500-ft. level of the Success mine. Its dimensions and importance are not yet fully demonstrated, but with this and other development at the 1400-ft. level of this property, a materially increased production has recently been made.

Zinc deposits at Pine Creek, a few miles south of Kellogg, have developed in a remarkably interesting manner within the past few months and show tonnage resources at this time that promise equal if not superior capacity to the Nine Mile deposits. They are equally rich in associated lead and silver values as well as in zinc, but of a more complex nature, due to a blending of iron sulphide with the more desirable minerals, a condition that is likely to involve the modern hydroelectric method of treatment for a full realization of their values.

The principal ore developments in the Pine Creek district are at the Denver, Highland-Surprise, Constitution and Douglas mines, each of which has been actively operated and gives evidence of an important tonnage capacity of relatively high-grade zinc ore. They will receive further careful investigation.

What promises to be an epoch-marking occurrence in the history of this remarkable smelting-ore district is the completion of the million dollar lead-silver smelter and refinery plant of the Bunker Hill & Sullivan Mining and Concentrating Co. adjacent to the company's big ore resources at Kellogg. The management hopes to celebrate the 4th of July this year by blowing in this big plant for the treatment of its great resource of lead-silver ore and custom ores of the Cœur d'Alene district. A most desirable site has been selected for this enterprise, elaborately planned for transportation and convenience, gravity handling, and supplied with every modern mechanical device obtainable, with a special eye to economizing in man-power cost of operation as well as all other possible cost-reducing means.

The refinery is directly connected with the blast furnace, and the molten metal produced will be kept in continuous motion until separated into a refined product of lead-silver and gold. This company should cut an interesting figure in the lead metal market of the future. Its special advantages in this connection include a broad previous experience of its directing head in the smelting business and a resource of the cleanest lead-silver mineral in nature, including a vast tonnage development below the Kellogg level of the Bunker Hill mine to a maximum depth of 4300 ft., at an average dip of 40°, and the fact that at that deep level the mine now exhibits the premier orebody of its history, which includes among others one shoot of mineral 500 ft. long with a maximum horizontal cross-section of 100 ft. that is nearly 50% clean galena whose only other associated gangue is crushed quartzite and iron carbonate without any visible mixture of objectionable associated minerals like zinc or iron sulphide.

In addition to this great resource of clean ore, this new smelting plant has obtained a long-time contract on the next cleanest lead-silver ore resource of the district, which comprises the entire output of the Hecla mine at Burke, whose expanding profits and ore-producing capacity in its deep levels has been one of the notable features of the Cœur d'Alenes during the last two years, and will combine to put this new smelting enterprise in an exceptionally strong position from the viewpoint of a large tonnage resource that will warrant continuous operation of the smelter for a term of years.

The recent announcement by Fred W. Bradley, president of the Bunker Hill & Sullivan, of the early construction of an electrolytic zinc plant at Kellogg, has been received with keen interest by the owners of the important zinc-ore deposits of the near-by Pine Creek district.

The Bunker Hill company has carried on extensive experiments in the treatment of complex ores at its Kellogg mill for several years past and is doubtless in a position to take full advantage of this feature of the business, which will supply, in addition to a local market for the zinc-ore producers, the necessary spelter requirements of the silver-refinery end of their big lead-smelting plant.

Work of the Engineers in the Field*

The work of the Royal Engineers with the original British Expeditionary Force is outlined and contrasted with changes required by experience. Their work performed between the retreat from Mons and the advance to the Aisne is briefly described. Duties of demolition require time and dispatch, as well as trench work. Mining plays an important part, some galleries being 400 ft. or more in length. Waste material sacked at the breast and moved by hand to the surface and used for parapets, revetments, or for dummy trenches which attract the hostile artillery fire as directed by aëroplanes.

THE Royal Engineers with the original British Expeditionary Force were divided into two classes: (1) Divisional engineers, under which were allotted for each division two field companies and one signal company; (2) engineer units on lines of communication, comprising fortress companies, works company, railway company, signal companies and printing company.

The "works" company was intended for work at the base, but owing to our numerous bases, it was split up into sections, one being at each base. Assisted by French civilian-labor contractors and working parties from any infantry available, they were responsible for the complete erection of the base camps, and all work in connection with them, such as water-supply, drainage, lighting, sanitary arrangements and road making.

They had at the same time to provide store accommodation for the large quantity of supplies and ordnance stores that were arriving, the work for the most part being adapting existing buildings and sheds to meet the requirements of those concerned—sometimes very difficult work. Their function at present is mainly the upkeep of the base camps, which are now run more or less on the lines of any town at home having its own organized engineer staff.

Use of Fortress Companies

The fortress companies did not come into active use until the Aisne, and from that time their work was essentially connected with that of the field companies. When the new armies were formed, army troop companies took the place of the fortress companies, and the latter name is no longer used. These army troop companies can be placed at the disposal of the chief engineers of the different corps, and their role is to assist the field companies in the construction of the defensive lines. They have been employed for the greater part on the second-line trenches and strong points.

The signal service may be roughly divided into two parts—communications in rear of division headquarters, and those in advance of division headquarters. In rear of the various division headquarters the majority of lines are of a semipermanent nature and the system is not unlike that employed in post offices. All the instruments used are similar to those in use in post offices at home. At the headquarters of armies and at the bases, high-power instruments are being employed, such as the Wheatstone automatic, which can send telegrams at speeds of 200 to 600 words per minute.

In advance of division headquarters a very highly trained personnel is required, as great mobility is essential. Cable can be laid from a cable wagon with horses going at a hard canter and can be picked up at the same pace. During the retreat from Mons, communication during the day was almost entirely by motor cyclist, but as soon as units went into billets, cables were laid from division headquarters to brigades each night, and again from brigade headquarters to battalions. This cable was picked up again before moving off each morning (usually about 3 o'clock), and I know of one division that lost only five miles of cable in the whole of the retreat.

About six years ago the whole signal service was reorganized, and when the war broke out it was hardly out of the experimental stage. The enormous importance of good communication has been recognized by all commands, and the personnel of the companies has been considerably augmented since the beginning of the war. The use of telephones for conversation between actual commanders was found almost indispensable, although early in the war practically all work was done by telegraph only. At the present time within a division there is a duplicate set of lines so that telegraphy and telephony are kept quite distinct. Each division has its own telephonic exchanges, and at a division headquarters there may be as many as 20 different lines to one exchange. The greatest task to which the communications within a division are put is in the attack, and several alternate lines are always laid to insure perfect communication.

Work of the Field Companies

The brunt of the engineering work in this war has fallen on the field companies, and the work accomplished by them includes almost every branch of engineering. To run briefly through the work performed by the field companies in the early part of the war, up to the end of October, 1914, when trench warfare began, the easiest way is to follow the movements of our troops and see what engineering work was carried out during the retreat from Mons and the advance to the Aisne.

At Mons on Saturday, Aug. 22, and the next morning, the Royal Engineers had their first experience of assisting the infantry in the preparation of a position for defense. The work consisted of giving advice as to the siting of trenches and then putting any special points such as a farm or small village into a state of defense. The shortage of tools was very noticeable at this period, and much time was spent in collecting all available types of shovels and spades from the neighboring district.

Late in the morning, on Sunday, an order came that the bridges over the Mons Canal had to be demolished. Eight sections, consisting of a subaltern, 20 men and one tool cart, set out for the bridges as fast as possible. Unfortunately, the distances to the bridges varied. Those close at hand were successfully destroyed; those

*Excerpt from a lecture by Lieut. C. G. Martin, Royal Engineers, delivered at the Royal Artillery Institution, Woolwich, Apr. 6, 1916. Reprinted from "Journal" of the Royal Artillery by Professional Memoirs, January-February, 1917.

at a distance were in the hands of the Germans when the Royal Engineers arrived; but at the intermediate bridges the Germans arrived while the sappers were at work—two sections were missing, one being entirely wiped out.

This brings up a most important point that everyone must grasp—the fact that Royal Engineer work takes time. To demolish a bridge is not the work of a minute, but may take three or four hours, the time depending on the construction of the bridge. Until this fact is realized, orders will still come in at the last moment, which, if successful result is to be attained, should have arrived two or three hours earlier.

On one occasion most of the sappers were put into the firing line alongside the infantry, and many instances of the same kind occur from time to time. This brings up another important point. Is it worth while using sappers as infantry? The answer is unquestionably "No," for it is absolutely essential to have the sappers available after the fight to assist in consolidating the new positions taken up. Of course, there are occasions where, in the last resort, the Royal Engineers had to be called upon to act as infantry, but it should be done only as a last extremity.

When the advance began, the nature of the Royal Engineers' work changed. From "destruction" we now turned to "construction"—engineer reconnaissance of roads—river crossings—demolished bridges—and fortified positions formed the bulk of the engineer work, and when the Aisne was reached, the sappers had their first opportunity of bridging on a large scale.

Replacing Bridges

The River Aisne has a mean width of about 170 ft. and a depth of about 15 ft. Five permanent bridges that had been demolished were at once made passable for infantry in single file, and later repaired to take mechanical transport. When one reads of bridge building, one's thoughts go to pontons, girders and other types of bridging; but from the sapper's point of view the actual construction of the bridge is the simplest portion of the task, the real hard work beginning when the approaches are begun.

To make a satisfactory approach to one of the bridges over the Aisne, a road about 200 yd. in length had to be made. This necessitated collecting brushwood for the construction of over 2000 fascines, their transport to the site of the bridge and the collection of all available road metal in the neighborhood.

Coming to the time when trench warfare was beginning, consider the composition and strength of a field company, which from a working-party viewpoint, consists of four sections, each under a subaltern and each being able, at full strength, to supply a working party of 30 men, but which under average conditions rarely exceeded 20.

The different calls that may be made on the Royal Engineers during trench warfare are: Site and mark out fire trench; distribute tools and place the men at the tasks; supervise construction; make traverses; lay out wire along front of trench, say 300 yd.; dig communication trenches back; make machine-gun emplacements in front trenches; construct dugouts for officers and men; revet trenches; make loopholes; arrange drainage; repair all damage and daily wear and tear; collect material for all above. The engineers got the same calls for the support line and also for the reserve line.

The brigade had, at the same time, calls on the field company, consisting of the four sections working as above, to make strong points near reserve line. The division also had calls on its three companies to construct the second line the same as for first line. The corps had its call on the Divisional Royal Engineers to put *points d'appui* behind second line into a state of defense.

Besides all this there were the following, by no means simple, undertakings: Cut, collect, and cart all material for trench work; manufacture hand grenades from stores available and train the infantry in their use; construct huts behind the lines for the rest camps. Later, when the two lines were drawing close together, the following additional calls were made on the section: Run out as many saps as possible toward the enemy; begin mining operations against the enemy.

Of course, under the conditions that existed at that time, the work could never have been done in some years. The only troops to assist the field companies at that time were one fortress company to each corps. The first and obvious method was to teach the infantry to do all the simple work on the spot and to continue training them until they could do all the ordinary field engineers' work, thus releasing the Royal Engineers for the more difficult tasks.

Infantry Working for Engineers

The following items illustrate some of the work which can be, and is now, undertaken by the infantry, under Royal Engineer supervision—after a thorough course of instruction by the Engineers—and which before the war was left by them entirely to the sappers: Erecting wire entanglements; complete digging, riveting, loopholing, traversing and flooring of the front, support, reserve and communication trenches of the first and second lines; repair of above-mentioned, necessitated by daily wear and tear; making any necessary saps. All these need no technical ability when the men have been once shown, and with a few weeks of supervision the infantry can carry them out with perfect success.

This leaves the Royal Engineers free for training the infantry in the simpler branches of engineering work, reserving for themselves the more technical duties, such as: In the front line—bombproof machine-gun emplacements, which consists of concrete and reinforced steel and where the ground admits, constructing deep shell-proof dugouts. In the first line—strong points. These small works require very careful siting and concealing, and it is on them that, in the event of a portion of the front lines falling, time is gained for the counter-attacks. These strong points should be weather-proof and as comfortable as possible. The same duties apply equally for the second line. The construction of *point d'appui*, or strong areas, in the rear. Here much technical work can be done with concrete and steel joists for machine-gun emplacements. Infantry parties are essential to assist with digging, carrying and filling sandbags, etc.

The work still remaining, which the engineer field companies were originally expected to do, is: Bomb manufacture; drainage; collection of material; and mining.

When the call was made to the field companies to undertake mining operations, it was seen that this work could be undertaken by them only at the expense of the work on the trenches, so special mining companies were formed at home and sent out at once. The mining companies are allotted to different parts of the front, as required.

The mining schemes are drawn out by the army, who inform the corps concerned, and are carried out by the companies. When mining operations have once started, work has to be kept up at as fast a rate as possible, and to insure success, reports of rate of progress, etc., have to be sent in regularly and as soon as possible. In the case of a mine being fired, reports are wired to the controller, giving all details, and these reports are passed on by him to general headquarters.

Coöperation again plays a very important part in the success of mining operations. Though in no way part of his command, the brigadier in command of an infantry brigade holding a length of trench is naturally much interested in the mining operations going on in this front, and the mining companies work in close conjunction with him, obtaining the necessary working parties to deal with sandbags, etc., and keeping him informed of progress of work, etc.

The usual gallery now used is about 4 ft. high, 2 ft. 6 in. wide at the top and 3 ft. at the bottom, measured inside the timbering; this means a section of some 12 sq.ft. Galleries have been run out 400 ft., which gives about 5000 cu.ft. of earth to dispose of. This will mean 4000 sandbags from each gallery.

Silence the Great Desideratum

The great secret of successful mining is "silence," and it has been found that the most satisfactory method of disposing of this earth is to put it in sandbags and drag them to the head of the shaft by hand or by a winch. Here the infantry should take the bags over for use in their fire trenches. In the event of their having a surplus, an excellent plan is to build a dummy parapet on any available ground high enough to cast a good shadow for aëroplane observation purposes. The Germans have been known to spend the best part of the day shelling such a dummy trench, which can only be distinguished with difficulty from a real one.

Work on the face of a gallery is carried out by three men—one working, one filling bags and one resting, the number of the remainder depending on the length of the gallery. The average rate of progress is about 12 ft. a day, but galleries in favorable soil have been run at the rate of 32 ft. in 24 hours. The depth of the galleries varies according to the tactical requirements, and may vary from 12 to 120 ft.

With regard to the charges used, there are two distinct types: A common mine, used with the idea of making a crater on the surface and destroying the enemy's work; or a *camouflet*, used to destroy the enemy's mining works underground and so charged as to leave the surface undisturbed. Mines to produce craters have been charged up to 13,000 lb., producing a crater 60 yd. long by 40 yd. across.

The charges of *camouflets* vary with the depth of the charge and the soil, and in some cases charges of two or three tons have been fired without disturbing the surface. The explosives used are those obtainable at the time. Ammonal, an explosive composed of ammonium nitrate and powdered metallic aluminum, has been used in large quantities with great success.

Drainage and ventilation are effected by pumps; continuous experiments have to be made to find the most silent and at the same time effective types. Lighting the galleries is carried out usually by candles, but electric torches have to be used when the mines are being charged.

Collecting material is perhaps, the most important and at the same time the most tedious of all Royal Engineer work. Originally, the companies cut what timber they could and collected from houses and villages all suitable material, but the local supply soon became exhausted and the matter had to be taken up on a large scale. There is one point that even many Royal Engineer officers are ignorant of, and that is the quantity of material necessary for putting the trenches in a fit state for occupation in winter. One sees type drawings of various trenches and shelters which are put forward as models to be copied, but when one comes to work out the material necessary, one finds that it cannot be obtained. There is never enough, and the supply, cost what it may, must be increased.

A detailed estimate was made out for one mile of front, including first and second lines and all communications. It was made where the breastworks are essential, owing to the low ground being water-logged. It gives some idea of the material required, and is as follows: Wire entanglement, 1,800,000 yd. of wire, or 900 miles, weight, 110 tons; standards or posts, 6 ft. long, 12,000; small pickets, 12,000; trench construction, 6½ million sandbags, weight, unfilled, 1000 tons; corrugated iron, about 36,000 ft. run; timber, average dimension, 3 x 3 in., 1,125,000 ft. run. In addition, large quantities of revetting material are required, including timber, planks, wire netting and expanded metal.

Time Required for Trench Construction

As to the time taken to complete the construction of one mile of such trenches to make them fit for winter occupation, an average man will fill and place in position on the parapet, parados, or dugout, at the most, 25 sandbags in one night. So, to fill and place the 6,000,000-odd bags will take a working party of a battalion about 240 nights' work, or about 8 months. If the sappers were to complete the job without assistance from the infantry, it would take a field company, with its usual working party of 80 men, about 6 years to finish.

This brings out the most important ideas: It is essential for the infantry to assist the sappers with every man they can spare; do not put off the preparation of the trenches for the winter campaign until too late. With every man working, it cannot be done under two or three months, and the time to start is, at the latest, the end of July. Of course the times mentioned—the 240 days and the 6 years—are based upon dealing with the material required in the perfect trench. In actual practice these amounts of material never reach the trenches. But it is not until everyone grasps the idea of the enormous quantities needed that the supply will be increased.

With regard to the state of training already reached by the infantry in field works, I should like to give the following example: In one division the divisional cy-

clists were handed over as a permanent working party to assist the Royal Engineers. They were allotted to a field company to be trained as a party for the construction of wire entanglements. This party, after a few weeks' training, assisted by sappers, total strength being 120 men, in 2½ hours ran an entanglement 1200 yd. long and 20 yd. wide in front of a newly captured position. They used 117 miles of wire, 1600 six-foot iron standards and 1600 pickets. Five days were occupied, before the attack, in carrying up the stores for the work and placing them in a handy position to begin work at the required moment.

I have been able to give only a very small idea of the work performed by the Royal Engineers. I have tried to show how, with the small establishment of engineers and the immense amount of work which the new type of warfare has necessitated, most of the old ideas on the legitimate duties of the Royal Engineers have changed.

The respective spheres of action of the Royal Engineers and infantry are now separated by a stream, the size of which is a measure of the difference in technical knowledge. The continual personal instruction of the infantry in all matters, formerly supposed to be the exclusive province of the Royal Engineers, is gradually draining the stream, and bringing nearer the time when the infantry will be as skilled in pioneer work as the regularly constituted pioneer battalions, while only the most advanced technical matters remain within the completely separated area of Royal Engineer activities.

Sulphuric Acid in Great Britain

The British Minister of Munitions has issued the following order:

No person shall as on and from June 11, 1917, until further notice manufacture sulphuric acid except under a license issued by or under the authority of the Minister of Munitions and in accordance with the terms and conditions of such license as to the quantities to be manufactured or otherwise.

No person manufacturing sulphuric acid shall as on and from June 11, 1917, until further notice use during any one calendar month more than 10 tons in all of 95% sulphuric acid (or its equivalent in acid of other strengths) for the purpose of all other manufactures, trades and businesses carried on by him except under and in accordance with the terms and conditions of a license issued by or under the authority of the Minister of Munitions.

No person shall as on and from the day following the date of this order until further notice supply sulphuric acid (including waste sulphuric acid) to any person except under and in accordance with the terms and conditions of a license issued by or under the authority of the Minister of Munitions. Provided that no license shall be required to supply not more than 56 lb. of 95% sulphuric acid (or its equivalent in acid of other strengths) to any person during any one calendar month. And provided also that any sulphuric acid supplied subsequently to the date of this order in pursuance of written directions or requests given or made by or on behalf of the Minister of Munitions previously to the date of this order shall unless and until such written directions or requests are canceled or withdrawn be deemed to have been supplied under a license issued under the authority of the Minister of Munitions within the meaning of this order.

As on and from the date of this order until further notice no manufacturer of sulphuric acid or agent of such a manufacturer shall charge or receive in payment for any sulphuric acid supplied by or through him a price exceeding the maximum price specified for sulphuric acid. Provided that the maximum prices shall not apply to—(a) Sulphuric acid supplied to persons outside the United Kingdom under export licenses. (b) Sulphuric acid manufactured outside the United Kingdom. (c) Sulphuric acid made wholly from brimstone. (d) Sulphuric acid specially purified for laboratory purposes.

All persons engaged in producing, manufacturing, selling, distributing or storing sulphuric acid (including waste acid), or in any manufacture, trade or business in which the same is used, shall make such returns with regard to their businesses as may from time to time be required by or under the authority of the Minister of Munitions.

For the purpose of this order the expression sulphuric acid shall include sulphuric acid of all strengths up to 100% H_2SO_4, but shall not include acid containing free SO_3 (commonly called oleum or fuming sulphuric acid).

Amalgamated Contract Nearly Completed

The contract entered into between Amalgamated Zinc (De Bavay's) Ltd., and American smelters has, according to the *Sydney Morning Herald*, about been completed, 5000 tons only remaining to be shipped. While the outlook was decidedly unfavorable to producers, it was hoped that something might be done to enable the company to ship concentrates. It will not curtail production. With the 100,000 tons of concentrates per annum sold to the Imperial Government, a contract for 45,000 tons of spelter per annum for ten years after the war was also entered into—half to be ordinary brands and half electrolytic. Under the contract the buyers guarantee a minimum price of £23 on ordinary brands and £28 on electrolytic. A corollary of this contract was the establishment of a plant to produce spelter to the amount of tonnage sold, and the Zinc Corporation has joined with other companies to determine whether a zinc-distillation works could be successfully established. This investigation is proceeding, but it will take some time before it will be possible to say whether the distillation process will be entered into in Australia.

AMONG THE NEWER USES FOR GRAPHITE, perhaps the most important is for preventing the formation of scale in boilers. This is a use which was originated and developed by the United States Graphite Co., according to W. L. Whitney, chemist for the company. It is now employed for this purpose all over the country. Its action is mechanical. Being soft and slippery, it prevents the particles of scale from adhering to one another or to the boiler. The scale is thus kept in a soft condition and is easily removed.

The Tayeh Iron-Ore Deposits*

During the time I was in charge of this mine, from 1914 to 1915, I had occasion to read the interesting papers by T. T. Read and C. M. Weld about these deposits, to find how far their observations corroborated mine. To quote from the paper on "The Mineral Production and Resources of China," by T. T. Read:[1] "The iron ores at Tayeh . . . lie along the contact between a marble and an intrusive body of a dark gray syenitic rock. . . . At one place it is slightly magnetic, apparently having been partly reduced to the magnetic oxide by the action of reducing solutions, which have deposited small amounts of copper and iron sulphides along the foot wall." To quote from the paper on "The Tayeh Iron Ore Deposits"[2] by C. M. Weld: "I find the orebodies described as occurring along an approximately E-W contact between hornblende-granite and limestone. . . . The granite is a granitoid rock consisting essentially of quartz, potash-feldspar and hornblende." These quotations show the differences of opinion entertained by two observers. My own study of these interesting deposits has been made intermittent amid the manifold duties devolving upon a superintendent. They may be of interest in view of the previous conflicting ideas.

General Description of the Deposits

The deposits are situated to the west of the Yangtse River, being connected with the river by a standard-gage railroad of 56 li (16.16 miles, 26 km.) in length. The general topography of the region is of mature age, showing broad valleys with sluggishly meandering streams. These deposits are worked as two mines, named the Tieh Shan Mining Department and the Teh Tao Wan Mining Department, the former consisting of three orebodies more or less connected, named Tieh Man Kan, Sha Mau Tze and Lung Tung, and the latter consisting of Chang Pei Shan, Sze Tze Shan, Ta Shih Men, Yeh Chih Ping and Tsin Shan, also more or less connected,

The deposits lie along the contact between an igneous intrusion, belonging to the hornblende-syenite group—the syenite of Read, diorite of Seltzer and hornblende-granite of Weld—and limestone. The hornblende-syenite, invariably in a decomposed condition along the whole length of the contact, presents the appearance of a decomposed alkaline aluminum silicate rock of a light brownish color, sometimes, though rarely, with a greenish tint to it, which is due to the greenish color of the partially decomposed hornblende. The essential minerals forming this rock, being medium-grained and of inequigranular fabric, are orthoclase and hornblende. The various stages of decomposition of the orthoclase mineral—from the fresh colorless crystals to a dull whitish kaolin product—can be clearly discerned with a field lens. It must be remarked here that there are two varieties of hornblende-syenite—the one, dark gray, near the partially decomposed rock next to the orebodies; the other, mottled white, which is farther off from the deposits and can be found as boulders and pebbles along the streams. The limestone occurs in various stages of crystallization, in which hardly any trace of contact minerals can be found. I am indebted to my assistant, W. A. Wong, for having found a layer of limestone thickly studded with crystals of garnet, not far from the orebody—the only layer of limestone with such contact mineral that I saw during my stay in Tayeh.

The deposits are more or less lens-shaped, having an approximate NW-SE strike and a NE dip of 60° to 70°, with the exception of the orebodies at Sha Mau Tze and Tsin Shan, which dip away from the igneous rock (SW dip); that is to say, the hornblende syenite forms the hanging wall, which is generally sharply distinct from the orebodies themselves, and the limestone the foot wall, which in many places is very irregular in outline, inclosing bunchy pieces of limestone, ranging from two to ten feet in diameter. The orebody at Tieh Man Kan has been faulted from the main trend of the other orebodies in a southwesterly direction. The iron ore is essentially composed of a mixture of magnetite and hematite, with occasional occurences of malachite, chalcocite and pyrite and rarely epidote and mica. Table I shows average analyses of the ore and of the limestone.

TABLE I. AVERAGE ANALYSES OF ORE AND LIMESTONE

Ore: No.	Localities	For	Fe, %	Mn, %	S, %	P, %	Al_2O_3, %	Cu, %	SiO_2, %	Sp. Gr.
1	Teh Tao Wan	Wakamatsu and Hanyang	62.93	....	0.029	0.049	....	0.238	5.42	4.64
2	Tieh Shan	Hanyang	59.45	0.63	0.319	0.109	1.05	0.292	9.16	4.13

Limestone: SiO_2, %	$Al_2O_3Fe_2O_3$, %	CaO, %	M_2O, %	Sp. Gr.
3.14	1.14	52.63	0.92	2.71

By analysis the discarded ore, dumped into the waste heap, has been found to contain as much as from 1 to 2% S and from 0.5 to 3% Cu. All the orebodies are more or less jointed, and the jointing planes are in a general way parallel to the hanging wall, along which is frequently found copper carbonate which must have been deposited and concentrated there from the leaching of the chalcocite found disseminated in certain portions of the orebodies.

Origin of the Deposits

I consider that these orebodies belong to the contact-deposit type and are the products of contact metamorphism; that the magnetite is primary—it has been in places partially or wholly altered to hematite, due to hydrothermal and pneumatolytic reactions, concomitant with the intrusion of the hornblende-syenite—and that the hematite thus originated has been carried forward by ascending telluric water, probably together with the aid of descending meteoric water, to replace metasomatically the intrusive and the limestone, especially along the contacts at certain particular spots. I have arrived at this conclusion from a consideration of the following facts:

1. As already noticed, the hornblende syenite along nearly the whole length of the contact is in a decomposed and altered condition, due undoubtedly to hydrothermal and hydro-metamorphism, that involves the development of kaolin and chlorite with traces of epidote, pyrite, quartz and calcite. This may be the result of the process of propylitization.

2. At Ta Shih Men, the hornblende-syenite changes to a light-brownish and yellowish color and is rather

*A paper by Chang Yu Wang, Hankow, China; to be presented at the St. Louis meeting of the American Institute of Mining Engineers, September, 1917.

[1]Trans. A. I. M. E. (1912), 43, 29-30.

[2]Trans. A. I. M. E. (1912), 44, 27-37.

soft, with scales of sericite, distinguishable megascopically. This is probably the result of sericitization, developing prominently in this particular locality.

3. The crystallization of the limestone to marble is undoubtedly due to its contact with the hornblende-syenite magma, with the development of a banded structure in the limestone, particularly discernible at Sha Mau Tze. This banded structure may probably be due to differing degrees of silification.

4. Near the main orebodies at Tieh Man Kan, irregular smaller bodies of ore rich in manganese are found in the limestone, which must owe their origin to the same magmatic emanation.

5. I regard the magnetite as primary and derived from magmatic emanation rich in iron, and the hematite as a secondary product from the oxidation of the magnetite. We can picture to ourselves how this process of hematization can be brought about. Chemically, magnetite is composed of the sesquioxide Fe_2O_3 which is hematite, and the protoxide FeO, which, being unstable, would readily be oxidized to Fe_2O_3 in the presence of active free oxygen under suitable pressure and temperature. Undoubtedly the gaseous vapor, during the intrusion of the syenite, furnished such oxygen. O. Silvestri has found as much as 18.97% of oxygen in the gas issuing from Mt. Etna. It is generally known that chemical reaction may or may not be favored by an increase of pressure, and this is why magnetite cannot be hematized either at or near the surface, or at great depth. Probably the gaseous emanation rich in magnetite and oxygen, on coming up from below, reaches a particular zone where the pressure and temperature are suitable to the combination of the oxygen and magnetite to form hematite.

6. Some of the hematite thus produced may be carried forward by telluric water, probably aided by descending meteoric water to replace metasomatically some portion of the rocks of both the hanging wall and the foot wall; this process of replacement is clearly shown where decomposed hornblende syenite is totally inclosed by hematite; from the occurrence of big bunchy pieces of limestone, as described, inclosed entirely by hematite, and from some hand specimens in which altered syenite is being replaced by hematite.

The output of iron ore from 1896 to 1914 inclusive, in round numbers, was about 3½ million tons. The ore in sight of these deposits, including Chang Pei Shan, which, being government property, has not yet been opened, has been estimated by three engineers to be 20, 30, and 100 million tons respectively. But according to my judgment, it would not be unreasonable to regard the ore in sight as 30 million tons and the probable ore in depth as 30 million tons.

Zinc Corporation Wins Suit

The Zinc Corporation claim of £84,000 against Aaron Hirsch & Sohn, for balance due on certain concentrates shipped prior to the war, was allowed in full by Justice Hood, in the Banco Court, Melbourne, Australia, on May 8, according to the Sydney *Morning Herald*. This is one of the suits that were made necessary by the "trading with the enemy" act, which prohibited the sale of the concentrates to the Germans, who in turn refused to make setlement for concentrates.

Braying at Mr. Hoover

Senator Reed, of Missouri, is a good man, but a born polemic, says the *Evening Post*. He would rather dispute than eat. A three hours' speech is a delight to him, if he is able to fill it with challenges to all and sundry. For him, propositions exist only to be controverted. Upon the most innocent-sounding statement he will pounce in order to show that it is dripping with fallacies, is unreasonable, unconstitutional and in derogation of God-given rights. He seems to have taken for his model that cantankerous Englishman of whom it was said that his mouth was always full of "cabbage and contradictions." He is full of objections and denunciations.

The waspish and litigious Senator from Missouri almost outdid himself yesterday in his attacks upon the food-regulation bill, and especially upon the plan to place its administration in the hands of Herbert Hoover. That gentleman became "some Hoover," somebody who had "left this country" to seek his fortune, and who had lived abroad so many years in touch with autocratic government that he was totally unfitted to understand the ways of free-born Americans or to have anything to do with "regulating their affairs." The proposal to make such a man "a King, a Czar, a potentate, a Cæsar, or a Kaiser" over us all was an offense to the pure soul of Senator Reed. In fact, we gather that he is rather opposed to the bill and does not love Mr. Hoover.

Senator Reed may not know it, but the place where he really belongs is Kronstadt. In the rules and regulations put forth by the mushroom republic of that island, it was stated that the government was to have no ministers, for everybody was to be on a perfect equality. It was added that no "outstanding personalities" would be tolerated, inasmuch as they would be "dangerous to liberty." It is almost a pity that this governmental theory did not live long enough to be tried out. We venture to affirm that if the Kronstadt republic had been permitted to do any business, some dominant man or group of men would have done it. Someone would have had to manage things. He might have done it under the guise of abject humility and complete deferring to the wishes of others, but he would have done it somehow. Human affairs cannot be directed except by some human being. And dread of unusual ability in public business belongs to the childish stage of democracy. Full-grown democracy is demanding greater efficiency in government; and when it gets hold of a remarkably efficient man, it delights to honor him and make use of him. And if all the mules in Missouri took to braying at Mr. Hoover, they could not obscure the fact of his singular fitness for the work which it is proposed to entrust to him. His years of skilled executive work, and especially the fruitful experience which he had as the head of the Commission for Belgian Relief, mark him out as a man who has come to the kingdom for such an hour as this. We ought to be thanking our lucky stars that we can command the services of an American whose peculiar genius for the kind of work he is to undertake in his own country has had admiring recognition in England and in France, in Belgium, yes, and in Germany, as well as the rest of the world.

The Scope and Value of State Mining Bureaus*

By E. K. SOPER
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The United States with the greatest and most varied list of mineral resources of any country, expends less money upon the industry than it should in view of its great importance. The extent and value of metals and nonmetals are pointed out.

OF ALL the nations of the world, the United States possesses the greatest and most varied mineral resources. According to advance figures of the United States Geological Survey, the gross value of all raw mineral products for 1915 amounted to $2,373,000,000. With the development of the arts, mining has assumed larger and larger proportions in this country, until today it occupies a place second only to agriculture in importance, and in a number of our Western States mining is the principal industry.

In spite of the phenomenal growth of the mining industry in this country and its intimate relation to our national welfare, which will become still more important with the close of the war, mining is not receiving anything like its just share of Federal and state aid. This fact is well shown by statistics prepared by the United States Bureau of Mines and presented in an address by Director Van H. Manning before the American Mining Congress in Chicago. The statistics show that if mining were to receive the same consideration as agriculture, considering the relative value of the outputs of the two industries, its proportion would be nearly four times as much as it is now, or $8,018,560, instead of $2,333,075. This does not take into account the money appropriated for agriculture by the various states nor under the Morrill Act, which runs into many millions more.

Appropriations for Agriculture and Mining

Another interesting comparison shows that the Federal Government in 1916 donated to the farmers one dollar for every $295 worth of products of the farms. It has donated to mining one dollar for every $1017 worth of products from the mines. The per capita contribution of the people for the betterment of agriculture is 34.8c., while the per capita contribution of the people for the betterment of mining is 2.3c. The total amount appropriated by the Federal Government in behalf of agriculture for 1915 was $35,553,852, while the total amount appropriated for mining was $2,333,075. This includes the total appropriations of the Bureau of Mines and the United States Geological Survey. The per capita production of agriculture is $102.94, while the per capita production of mining is $23.26. Thus while the value of the agricultural production of the country is about five times that of the mineral production, the per capita appropriation for agriculture is 15 times the per capita appropriation for mineral investigations.

In citing these statistics I would not intimate for a moment that agriculture is receiving more state and federal aid than is justified. I believe mining men would be among the first to support any worthy effort to increase the yield of our soils, improve the breed of our stock and better the conditions on our farms, but it will be apparent to anyone who will examine the facts that mining is not receiving the share of Federal and state aid that it deserves. This is partly due to a lack of organization in the mining industry, developed to a very high degree among the agricultural interests, and partly to a failure on the part of the public to understand the real nature of mining as a business and its importance to the economic and industrial welfare of the state and nation.

Until a few years ago there was no Federal Bureau of Mines and only two or three of the states maintained mining bureaus. Under the able leadership of the late Dr. Joseph A. Holmes the Bureau of Mines was organized to take over the work in mineral technology and fuel testing previously done by the Geological Survey and to carry on investigations toward furthering mining and metallurgical activities and improving the welfare of those engaged in mining.

The great benefits derived from the work of the Bureau of Mines, even in the short time that it has been in existence, first under the late Dr. Holmes, and now under Director Manning, are to be seen on every hand—in efforts to minimize the danger of mine explosions; in its safety investigations; in its mine rescue work; in its educational campaign among the workmen; and in the prevention of waste in mining. In addition, the Bureau of Mines has accomplished much through its investigations of more efficient mining, milling and metallurgical methods; in its experiments to determine workable methods for the treatment of low-grade and complex ores; in its petroleum and natural-gas investigations; and in many other activities.

Work of the Bureau of Mines

Notwithstanding the value of the work already accomplished, little more than a start has been made. The Federal Bureau of Mines, because of the limited appropriations, cannot begin to do the work that the mining industry demands. Even with increased appropriations there are many problems peculiar to individual states which can be solved only by the active coöperation of the states concerned. Moreover, work in the various so-called mining states can be done in much greater detail and investigations and surveys can be conducted with far more thoroughness under the active support and direction of the various states. This can best be accomplished through state mining experiment stations or state mining bureaus, coöperating with the United States Bureau of Mines, just as nearly all the states maintain geological surveys, coöperating with the United States Geological Survey.

Recognizing this fact, most of the Western States have established mining experiment stations or mining bureaus, and under recent agreements with the United States Bureau of Mines the state organizations coöperate with the Federal bureau.

*Abstract of address before the Idaho Mining Association, Boise, Idaho, Jan. 16, 1917.

Among the states that maintain mining experiment stations or state mining bureaus, most of which are in connection with the schools of mines of the respective states, are Arizona, California, Colorado, Minnesota, Missouri, Oregon and Utah.

The scope of these state mining experiment stations is well stated in the Utah act creating a station in that state. The particular purposes for which the Utah station was established are there stated to be the "finding of ways and methods of profitably treating low-grade ores, of securing a higher percentage extraction of metals from these ores, of obtaining other information that shall have for its object the benefit of the mining industry and the utilization and conservation of the mineral resources of the state, and to publish and distribute bulletins and articles relating to the department and its work."

The coöperative plan under which most of these organizations work is essentially as follows: The work is under the direction of the officials of the state experiment stations and of engineers and metallurgists of the United States Bureau of Mines assigned to duty at these state experiment stations by special arrangement with the Federal bureau. The operating expenses are thus shared by the state and the Federal Government, the latter usually paying the greater part and never less than half. Under such a coöperative agreement, for every dollar appropriated by the state for the support of a state mining bureau the Federal Government appropriates an equal amount, the total to be used entirely within that state for research or for other activities relating to the mining industry. The results of the investigations thus carried out are published at the expense of the Federal bureau and distributed free to all persons interested.

State and Federal Coöperation

An agreement has just been reached between the mining department of the University of Idaho and the United States Bureau of Mines for coöperative work in Idaho. Under the terms of this agreement the Federal Bureau of Mines is to appropriate funds equal in amount to those appropriated by the state to carry on the work and, in addition, to bear the expenses of the publication of reports and bulletins. The plan is to make a careful survey to determine just what the problems are in Idaho and to undertake investigations and experiments looking toward their solution. In order to make a start and to secure this coöperation, since the state as yet makes no provision for mining and geological research, the mining operators of the Cœur d'Alene district generously contributed a fund which was increased by an equal sum from the Federal Bureau of Mines. A competent metallurgist and assistant from the staff of the United States Bureau of Mines will be assigned to duty at Moscow in the near future to begin this work.

Idaho, through the fame of the Cœur d'Alene region and the numerous mining districts in the central and southern parts of the state, is one of the great mining states of the West. It contains extensive mineral resources as yet largely undeveloped throughout its entire area. According to State Mine Inspector Robert N. Bell, the production of Idaho's mines for the year 1916 will exceed $48,000,000 gross value, representing a profit of $11,500,000. Moreover, there are numerous mineral deposits in this state which were worked twenty to forty years ago until the rich, oxidized or free-milling ores near the surface were exhausted, when the properties were abandoned or closed down, leaving large bodies of lower-grade and more refractory ores untouched. Many such deposits are known in Idaho, the exploitation of which only awaits the development of improved methods of extraction of the metals contained. Furthermore, there are extensive known deposits of ore in the state, which remain undeveloped because they are too low-grade or complex to be profitable under present treatment methods.

An important part of the work of a state mining experiment station should be to make free determinations of ores for prospectors and, when called upon, to give information to prospectors regarding the nature and value of their ores and to advise them concerning development problems.

State Geological Surveys

The object of state geological surveys is twofold—to call attention in accurate and reliable terms to the state's mineral resources, and to render all possible aid in the proper development of these resources by furnishing the prospector, the miner and the farmer with accurate information concerning them. The investigations conducted by state geological surveys generally include: (1) Mineral resources; (2) geologic and topographic maps; (3) underground water resources; and sometimes (4) soils and (5) water power.

The results of the investigations are published in the form of geologic and topographic maps and as reports or bulletins describing the occurrence, character, and value of the mineral deposits of the state. When the state surveys are conducted in coöperation with the United States Geological Survey, these reports are usually patterned after those of the latter in form, but not necessarily in subject matter. Many reports of the United States Geological Survey, are purely scientific in character and have little direct practical value to the prospector or miner. Often such scientific research ultimately proves to be of great indirect economic value, and this branch of the work of the United States Geological Survey is of great importance. However, state geological surveys, especially those in states which, like Idaho, possess enormous undeveloped resources, should avoid such work and devote their efforts to investigations and surveys of direct practical value which will stimulate the legitimate development of the resources of the state.

The United States Geological Survey has followed a policy of coöperating with the various states. It is the custom of the Federal Survey to spend in any state at least as much money as the state itself appropriates for geological work. Moreover, it spends this money in coöperation with the state survey, which enables the state to direct the investigations so that the work will be done where it is most needed.

In order to make clearer the advantages of state geological surveys, some of these advantages may be outlined under the following heads:

The most experienced prospectors are constantly finding rocks and minerals that they cannot identify. In states where geological surveys are maintained, pros-

pectors and others may send rocks and minerals to the survey for free identification and opinion as to possible value.

Certain rocks and certain areas are far more likely places for the finding of mineral deposits than others. On the other hand, there may be certain areas in the state where it would be a waste of time to prospect for metallic ores. It should be the duty of a state geological survey to point out these favorable and unfavorable localities and assist the prospector in every way possible.

Development Work

In the early, or development, stages of a mine, especially if it is in a new district, a thorough understanding of the geology of the deposit and surrounding locality is of the greatest importance in laying out the work. Nearly all big mining companies employ a geologist, in addition to the regular technical staff. Mines in new districts and in the development stage can seldom afford to do this, and often serious errors are made, due to a failure to interpret correctly the geological conditions. State geological surveys should be prompt to examine and accurately map the geology of all new districts, thus giving the operators the advantage of the geological evidence while the need for it is urgent.

There are undoubtedly many valuable mining properties that are now idle because of a failure to understand the geological conditions. The frequency with which faults cause disappearance of the ore is well known. Detailed geological examinations of mining districts, either new or old, will in many cases bring to light new orebodies and open up new possibilities. The actual value of geological surveys to the mining industry is well shown by the respect in which the reports of the United States Geological Survey are held by mining men everywhere. While it is true that these reports have at times been critcized as to certain statements and conclusions, nobody will deny that they have been of immense value to the mining industry; as for example, in Cripple Creek, Bisbee, Globe, Leadville, the Cœur d'Alenes, Butte and other mining districts.

However, the United States Geological Survey cannot cover all the new discoveries in the various states, and hence delays are inevitable. This is another strong argument for state coöperation with the Federal Survey through state geological surveys, for under such an arrangement new discoveries can be promptly investigated, and if they seem promising, geological maps and reports can be prepared.

Nonmetallic Resources

Idaho contains many valuable mineral deposits of a nonmetallic nature, the value of which has been frequently overlooked, especially during the last few years, when the price of lead, silver, zinc and copper has been the chief topic of discussion. The vast deposits of high-grade rock phosphate which occur in the southeast part of the state constitute a source of great potential wealth. But more detailed surveys of these deposits are needed and reports on treatment methods and markets for phosphate rock. Such investigations might well be undertaken by a state geological survey. In addition to her metallic wealth and her great phosphate fields, Idaho contains commercial deposits of excellent clays of all kinds, including some of the highest-grade fireclay in the United States recently discovered and developed near Moscow; building stones, cement rock, limestone, mica, asbestos, marl, volcanic ash, gypsum, infusorial earth and precious stones. Other minerals that may reasonably be expected to occur in Idaho in commercial quantities include: Monozite sand, salt, barite, ocher, molding sand, glass sand, abrasives, natural gas and petroleum. A state geological survey should issue bulletins describing in clear, nontechnical language the occurrence, characters and uses of these substances, the places in which they are most likely to be found, as well as all places from which they have been reported. This would stimulate the search for them.

Road Materials

In the construction of roads and state highways the distribution and properties of rock, sand and gravel are of great importance to the engineers in charge. State geological surveys should work with the state highway commissions in determining and locating the best materials available. California, the banner state in the construction of fine state highways, employs a large staff of geologists whose entire time is devoted to work for the state highway commission. A bulletin upon the subject of road materials recently published by the Oregon Geological Survey was so well received that the entire edition was soon exhausted.

Those Western states that do not already have geological surveys would find it a profitable investment to establish and maintain a combined bureau of mines and geology. Such a bureau should consist of a mining experiment station and a geological survey, and the work should be done in coöperation with the United States Bureau of Mines and the United States Geological Survey under a plan similar to that adopted in many other states.

Holland's Trade in Tin

The imports of tin into Holland during 1916, from the Dutch East Indian Islands of Banka and Billiton, and Straits settlements, according to *Commerce Reports*, June 2, 1917, fell far behind those of any previous year. This decrease during the last three years is shown by the following figures: 1914, 11,438 tons; 1915, 4899 tons; 1916, 1850 tons. The Netherlands Trading Co., of Amsterdam, distributed practically all the tin imported.

Tin exports from the Netherlands, in 1915, amounted to 5807 tons, Germany receiving all but 10 tons. In 1916 only 37 tons was exported. Much Banka tin is shipped direct from Batavia to the United States, France and Great Britain. The Billiton Company sold during 1916 approximately 6932 tons at the Batavia and Singapore markets.

Pig Iron Production in Italy in 1916 was 454,923 metric tons, an increase of 182,014 tons over 1915.

Imports in 1916 were 302,333 tons as compared with 240,366 tons, in 1915, and 221,689 tons in 1913. Included in the 1916 output was 7000 tons of electric furnace pig iron against 2800 tons in 1915. The charcoal iron production was 5090 tons, and the amount of 80% ferromanganese, 4500 tons.

Cementation as Applied to Mining*

The properties of cement have been taken advantage of in many ways in dealing with problems of various kinds in mining, and its practical use is widely known. During the last few years, however, its field of application in special cases has been enlarged and it has been found practical to employ cement for conditions under which it was previously considered unsuitable and useless.

It has been found that cement can be introduced into almost inaccessible places, such as fissures or cracks in strata and concrete foundations, by a mixture with water and under high pressure.

The ordinary grouting methods of running cement into cavities are well known, and earlier attempts at the cementation process were based principally upon the methods of grouting, but slightly high pressures, of several hundred pounds per square inch were applied by means of direct-driven force pumps.

Such pressures were found insufficient to obtain the desired results in mining, where water pressures frequently as high as 500 lb. per sq.in. were encountered, consequently pressures up to 3000 lb. had to be employed in some cases, and with success.

Among the cases in which cementation has been successfully applied may be included. Shaft sinking and level driving; underground fires; defective bore holes and defective shaft lining.

Cementation in Shaft Sinking

Cementation as applied to shaft sinking consists of a thorough treatment of the material through which it is desired to sink, by the injection of cement into all the existing cracks and fissures in the ground, thus rendering them practically water-tight, previous to the beginning of actual sinking operations.

The mode of operation may be divided into two distinct methods of application: Bore holes through which the cement is introduced into the ground inside the perimeter of the shaft required to be sunk; bore holes through which the cement is introduced into the ground outside of the perimeter of the shaft, in a similar way to the bore holes used in the freezing process.

The former of these methods has the advantage of indicating clearly the position of all water-bearing fissures and also gives an approximation of the size and extent of such fissures, as both quantity and pressure of water are registered as soon as any fissures are encountered.

The cementation is carried out in successive stages; that is, a predetermined length of ground is first treated, sunk through and then lined. After this work has been finished, an entirely fresh set of bore holes is put down inside the perimeter of the shaft.

On reaching a fissure containing water, this water rises up the bore-hole casing. A stop valve is fitted on this casing, and the water is kept under control until dealt with by cementation.

The second method, in which holes are bored outside of the shaft perimeter, is said to have the advantage in that sinking and cementation can be carried on simultaneously. This, under certain conditions, may be attended with satisfactory results, but when bore holes are put down to intersect a variety of fissures, there is less likelihood of obtaining successful results. There is always a tendency for the cement to follow the lines of least resistance during injection, in such a way that if the bore hole should intersect a large fissure adjacent to several small ones, the most extensive fissure would be filled, whereas the smaller would be filled only in the immediate vicinity of the bore holes, and upon proceeding with sinking, water may be encountered as the result of imperfect injection.

Suitable Material for Cementation

The cementation process can be employed satisfactorily in practically all kinds of rock, both porous and non-porous, but is of no value in the case of a surface quicksand. Among the various kinds of strata that have been treated are limestones, sandstones, gritstones, chalk and marls.

The first trial of cementation with the interval method of boring was carried out at the Mine de Marles in 1908, upon an abandoned shaft that had collapsed in 1854, had run in and filled with water.

The crater formed by the collapse of this shaft was 92 ft. in diameter. A strong concrete raft was constructed through which bore holes were put down and cementation was commenced, the object being to solidify the broken material and to fill the fissures at the points where the feeders of water existed. The strata in this case consisted of chalk, and the results were highly satisfactory. The work was carried out under the direction of M. Deffieux, chief engineer of the company.

At Hatfield Main colliery, ordinary cementation was of no service, it being found impossible to introduce cement into the ground to any useful purpose, as it was washed out by the pressure of the water. Instead of discarding the process altogether, silicate of soda and sulphate of alumina were used and, when mixed, formed a gelatinous precipitate which sealed the pores of the sandstone and permitted the sealing with cement.

Cementation in Underground Dams

High-pressure cementation has proved to possess great advantage in closing off underground feeders of water in connection with underground dams. In the first place, dams that have been constructed to meet unexpected inrushes of water have been put in with all possible speed, and sometimes the work has been improperly matured and set before being subjected to water pressure. Leakage occurring may be through openings of very small area, although in many places, and high-pressure injection of cement solves the problem, closing crevices in brickwork or stonework.

Crevices that have permitted air to enter into a fire zone have also been cut off, defective bore holes successfully remedied, and many old shafts that have been lined with stone or brick and have not been watertight have been made so.

It would be interesting to have a description of the mechanical equipment necessary for applying the principles involved, such as the method of mixing the cement, and of pumping it into the territory to be sealed, as there are many questions which will suggest themselves to those to whom the process is of more than passing interest; it is to be hoped that other papers along this line will also give approximate costs of work of this class.

*Abstract of a paper by Thomas Blandford, prepared for the Midland Institute of Mining, Civil and Mechanical Engineers.

Spelter Statistics for 1916

BY W. R. INGALLS

REVISED and complete statistics of the zinc industry of the United States in 1916 are given in this article, full reports having been received from all of the ore smelters. I did not undertake to collect the statistics of production by the dross smelters in 1916, and the total of spelter production available for consumption is short by just so much. Some of this spelter is as good as, some of it is even better than, prime Western, this referring to redistilled spelter. Simple remelted spelter is, of course, inferior. In a statistical investigation of this subject it is difficult to draw the line between spelter recovered *after use* and spelter reworked from waste *in the course of manufacture.* The former is a true addition to the supply available for consumption; the latter is merely an incident to consumption. About all that may be safely said statistically on this subject is that there is a rather large production of reclaimed spelter and that statistics of consumption that do not take it into account are incomplete.

It will be observed that the statistics of spelter production now reported differ materially from what were published in the *Engineering and Mining Journal* of Jan. 6, 1917. This is owing chiefly to some omissions from the preliminary report. The number of smelters was increasing so rapidly in 1916, that it was difficult to keep track of them. The revised total is about 11,000 tons larger than the preliminary report. The error in the latter, however, was only a little more than 1 per cent., which is a sufficiently satisfactory result with respect to statistics of the production of nearly 700,000 tons of metal that are collected within two or three days after the termination of the calendar year.

Production—The total production of spelter by ore smelters in 1916 was 683,004 tons, against 507,142 tons in 1915. In 1916 there were 14 ore smelters who produced spelter from dross to a more or less extent, an increase of two over the previous year. The production from dross, skimmings, etc., was 11,681 tons in 1916, against 12,538 tons in 1915.

The production of spelter by quarters exhibited a fairly steady increase right through the year. In the first quarter there was a gain of about 6000 tons, in the second of about 10,000, in the third of about 2600 and in the fourth of about 20,000, each quarter being compared with the next one previous. These figures indicated no especially noteworthy features such as the entry of some large new plants. On the contrary, the increases were fairly distributed by districts. Some of the works showed decreases while others showed increases, generally outweighing the decreases. There were only two works operating in the early part of the year that were idle throughout the fourth quarter, and both of them were small. On the other hand, several plants that were idle during the first quarter resumed operations later. Several new plants, some of them fairly large ones, began to be productive during the fourth quarter. Among these were Quinton, Picher (Henryetta), Checotah, Western, Arkansas and Fort Smith. This explains the large increase in production in the fourth quarter. It is worthy of remark, moreover, that neither of the great new institutions of the business—Donora and Great Falls—produced up to expected capacity. In both cases there was increasing production quarter by quarter, but even in the fourth quarter their outputs were considerably below what they are designed for.

PRODUCTION OF SPELTER

(In Tons of 2,000 Lb.)

By Ore Smelters Only

States	1912	1913	1914	1915	1916
Arkansas					7,637
Colorado	8,860	8,637	8,152	8,984	8,908
Illinois	94,902	111,551	130,587	161,665	181,495
Missouri-Kansas	111,761	85,157	53,424	111,052	154,396
Oklahoma	76,837	83,230	92,467	111,405	169,064
East and others (a)	56,278	69,687	85,682	114,036	161,504
Totals	348,638	358,262	370,312	507,142	683,004

(a) Includes Anaconda and other electrolytic production in 1915 and 1916.

SPELTER PRODUCTION, 1913-1916, BY QUARTERS

(In Tons of 2,000 Lb.)

Reports of Ore Smelters Only

District	I	II	III	IV
1913				
Illinois	27,924	28,523	26,118	28,986
Kansas-Missouri	22,006	23,820	19,204	20,127
Oklahoma	21,430	21,840	18,502	21,458
Others (a)	20,722	20,153	19,238	18,211
Totals	92,082	94,336	83,062	88,782
1914				
Illinois	31,005	32,482	32,512	34,588
Kansas-Missouri	13,939	14,659	13,193	11,633
Oklahoma	22,563	22,960	22,945	23,993
Others (a)	22,717	22,715	24,106	24,295
Totals	90,224	92,816	92,756	94,516
1915				
Illinois	35,786	39,511	41,791	44,577
Kansas-Missouri	14,090	24,554	32,152	40,256
Oklahoma	24,713	26,984	28,613	31,095
Others (a)	26,255	30,575	31,360	34,830
Totals	100,844	121,624	133,916	150,758
1916				
Illinois	45,344	45,547	41,953	48,651
Arkansas			2,977	4,660
Kansas-Missouri	38,513	42,488	39,447	33,948
Oklahoma	34,994	38,786	42,604	52,680
Others (a)	37,853	40,264	42,662	49,633
Totals	156,704	167,085	169,643	189,572

(a) With the exception of one plant in Colorado these are all Eastern works. In the fourth quarter of 1915 and in 1916 is included Anaconda and other electrolytic production.

Spelter Production According to Fuel—Of the total spelter production of the ore smelters in 1911, concerns using coal as fuel produced 119,989 tons, or about 40% of the total. In 1912 they produced 134,077 tons, which was only about 38% of the total. In 1913 their production was 157,653 tons, or about 44% of the total; in 1914 it was 173,520 tons, or about 48% of the total; in 1915 it was 227,143 tons, or about 45% of the total; and in 1916, it was 289,007 tons, or about 41% of the total. The remainder of the production was made by smelters using natural gas as fuel. Up to 1915 there was a general tendency toward increasing production by the smelters using coal as fuel, their proportion of the total output having risen from 40%, in 1911, to 48% in 1914. In 1915 it fell to 45%, in spite of the revival of smelting at Pittsburg, Kan., which is easily explained. There were a lot of inactive natural-gas smelteries that could be put quickly into operation, which was done, and moreover, it was quicker and easier to build new plants in the natural-gas fields than in the coal fields. The same conditions continued in 1916, and the ratio of the spelter produced by smelting with coal fell to 41%, which takes us about back to the situa-

tion of 1912. The extension of the production of natural gas in Oklahoma, the opening of new fields in Arkansas and the ease and relatively small outlay of capital for the erection of natural-gas smelteries are the explanation of this.

Electrolytic Zinc—The production of electrolytic zinc in the United States in 1916 was 13,949 tons. The Consolidated Mining and Smelting Co., of Canada, at Trail, B. C., produced 2986 tons. Since the end of 1916 the production of electrolytic zinc, both in the United States and Canada, has increased largely. Not only have the plants at Trail, B. C., and Great Falls, Mont., been raised to something approximating their contemplated production, but also the Judge Mining and Smelting Co., Park City, Utah, and the United States Smelting Co., at Kennett, Calif., have begun production. The Bunker Hill & Sullivan company has announced that it is going to build an electrolytic zinc plant at Kellogg, Idaho.

There was a considerable production of electrolytic zinc in Japan in 1916, the process having been first introduced at a works of the Kosaka mine, and extended to the Nishitori, Ajikawa, Takata and Inawashiro works of the Kosaka Zinc Co. Besides these, the Mogi works at Uji, the Kano Electric Zinc Co., the Fukushima and Onahama works of the Electro Zinc Co., the Isoshima works of the Zinc Electro-Refining Co., the Japan Electric Zinc Co. and the Zinc Electrolyzing Co. were established in rapid succession, and some of these works are now in operation while others are under construction.

The Electrolytic Zinc Co. of Australia began the erection of a plant at Risdon, near Hobart, Tasmania, for the production of electrolytic zinc from ore produced at Broken Hill, and expects to be producing by September, 1917. Interests identified with the Mount Lyell company of Tasmania are contemplating on electrolytic zinc plant in Tasmania for the treatment of the ore of the Roseberry mine.

It is evident that a great expansion in the production of electrolytic zinc in many parts of the world is assured.

General Conditions of Ore Supply—The reports as to ore receipts give some interesting indications as to practice in smelting and as to market conditions. The smelters who make sulphuric acid continue, as in the past, to draw their ore mainly from Wisconsin and from the Joplin district (including Oklahoma). For the manufacture of sulphuric acid this ore is recognized to be superior, but it is noteworthy that several of the zinc acid makers are using a larger and larger proportion of Western ore. Out of the total number of works —52—there were 16 in 1916 that used nothing but ore from the high grade districts, viz., Missouri, Kansas, Oklahoma, Wisconsin and Arkansas, the total quantity taken by them from those states being 270,950 tons.

There were 11 works that did not use any ore from the high grade districts, their chief supply being ore from the Rocky Mountain region and from foreign countries. Imported ores were smelted by 23 works. In 1916 Australian ore was received at eight smelteries, five of which were east of the Mississippi River, the remainder being in Oklahoma. There were two smelteries at which practically nothing but calamine was used.

Ore Smelted—The smelters reported that in 1916 they treated 1,203,837 tons of blende and 510,075 tons of calamine, a total of 1,713,912 tons. In 1915 they smelted 848,776 tons of blende and 339,299 tons of calamine, a total of 1,188,075 tons. As I remarked last year, it should not be attempted to draw too fine distinctions from these figures respecting either the quantity or the average yield of the ore smelted, some smelters apparently having reported "ore received" as "ore smelted," and there was probably some other confusion respecting this inquiry. However, we may draw some rough deductions.

In 1914 the calamine smelted was about 26½% of the total; in 1915 it was about 28½%, and in 1916 about 29¾%. The same tendency to use a larger proportion of calamine in smelting was therefore exhibited in 1916 as in 1915, but the increase was not so marked as it was between 1915 and 1914.

Deducting from the total production of spelter the quantity that was derived from dross and skimmings, and adding 90% of the production of zinc dust, the zinc yield from 1,713,912 tons of ore smelted in 1916 was 39.4%, corresponding to an average grade of 47.2% for the ore, assuming an average extraction of 83⅓%. Figuring in the same way, the zinc yield of 1,188,075 tons of ore smelted in 1915 was 41.7%, corresponding to an average grade of 50%. Figuring in the same way for 1914, but assuming an average extraction of 86%, the zinc yield from 855,435 tons of ore was 43%, corresponding to an average grade of 50% zinc for the ore. The assumption of average yields of 83⅓% and 86%, respectively, is based on nothing but conjecture. We know, beyond any doubt, that the actual yield in 1915 and 1916 was lower than in 1914, owing to production being pushed at the expense of good smelting.

Receipts of Ore—The receipts of ore by smelters in 1916 showed another enormous increase, the grand total having been 1,777,891 tons compared with 1,257,528 tons in 1915. These totals include the receipts of ore by the smelters only, and do not include the ore that was taken by the manufacturers of zinc oxide or what was used by the producers of electrolytic zinc.

The statistics for the United States do not require any extended comment. In the case of almost every state there was increased production, which was especially large in the Joplin district. The important Western states—Montana, Colorado and Idaho—made large gains. Wisconsin and Tennessee, which produce high grade ore, did not advance proportionately to any such great extent as they did in 1915, but in Oklahoma, which also produces high grade ore, there was a very important gain.

A feature of unusual interest was the large quantity of ore derived from foreign sources, especially from Mexico and Australia. Large quantities of ore were received from Spain and from Africa, while small quantities were drawn from a considerable variety of sources, even from China.

The aggregate of ore receipts in 1916 was considerably larger than the aggregate of the ore smelted, just as was the case in 1914 and 1915. The explanation of this feature in 1916 must in the main be the same as in the previous years, namely, the stocking up of new plants. A large tonnage of ore must always be carried in the bins for a working reserve, a sort of bal-

ance wheel, so to speak. Not until a considerable number of plants go out of operation, and not until there be a general contraction in smelting, shall we see statistics showing a greater quantity of ore smelted than received. However, I desire to point out in this connection that extremely fine deductions should not be drawn from these statistics, for, although they are compiled from returns made by all the smelters, it is possible, nay, even probable, that some smelters misunderstood the inquiry and unintentionally made incorrect returns. This, of course, is a factor that enters into all statistics.

RECEIPTS OF ZINC ORE

(In tons of 2,000 lb. This table includes the receipts of ore by the smelters only and does not include the production of ore exported or what was taken by the manufacturers of zinc oxide.)

State	1911 (a)	1912	1913	1914	1915	1916
Arizona	6,395	11,937	9,347	6,357	14,718	17,243
Arkansas	860	1,567	1,500	1,737	7,017	12,854
California	3,754	6,639	6,796	8,827	27,445	41,291
Colorado	158,528	212,423	220,166	164,739	148,359	194,418
Idaho	9,667	19,482	31,835	57,001	78,767	104,575
Kentucky	575	947	441	434	1,863	2,460
Missouri-Kansas	268,500	289,177	280,000	247,723	278,099	369,397
Montana	56,593	34,034	91,257	125,663	200,528	233,645
Nevada	5,666	20,654	22,313	20,447	24,949	51,670
New Mexico	10,184	25,889	14,593	15,369	37,042	35,734
Oklahoma	8,750	4,325	23,500	26,247	25,231	42,799
Tennessee	3,439	6,635	8,297	18,708	38,527	43,309
Utah	19,933	24,539	27,073	20,322	21,535	43,240
Wisconsin (b)	71,565	90,762	89,662	74,311	90,128	91,561
Others	44,896	56,099	57,241	57,936	122,490	111,273
Totals	669,305	805,109	884,021	845,821	1,116,698	1,395,469
Mexico	28,596	29,436	19,965	16,414	49,171	142,687
Canada	2,356	9,707	6,012	10,532	14,000	31,877
Australia	.....	.....	.....	.....	68,448	134,464
Other foreign	.....	.....	.....	.....	9,211	73,394
Grand totals(c)	700,257	844,252	909,998(c)	872,767	1,257,528	1,777,891

(a) Smelters' receipts: reports missing from three small smelters. (b) Including Illinois and Iowa. (c) In addition to the ore reported from Canada and Mexico, zinc smelters received a few thousand tons from Europe and Eastern Siberia in 1913.

Spelter Stocks—The stock of spelter at works on Dec. 31, 1916, being the aggregate of the reports of all the smelters, was 16,085 tons, compared with 14,300 tons at the beginning of 1916. These figures include both high-grade and common spelter.

Sulphuric Acid—In 1916, there were 10 smelters who produced sulphuric acid from blende, the same number as in 1915. The enumeration is, however, open to some criticism, owing to complications that are developing in the industry. It is often good business to roast the blende at a good center for the distribution for sulphuric acid, and reship the roasted ore to a good point for zinc distillation. The Western Chemical Co. has for a long time roasted ore at Denver, Colo., and sold the product to smelters. The National Zinc Co., has no roasting furnaces at its smeltery at Springfield, Ill., which gets its ore from the roasting plant of the company at Argentine, Kan. Similarly the Grasselli Chemical Co. roasts at Canton, Cincinnati, Newcastle, Cleveland and Grasselli the ore that is needed by its smelteries at Clarksburg and Meadowbrook. The New Jersey Zinc Co. has a roasting plant at Tiltonville, Ohio, which supplies other smelters. With the movement of the zinc-smelting industry to the eastward, the separation of blende roasting and zinc distillation is becoming more marked, as it has been for a long time in Europe. It will appear from this that the definition between zinc smelters' acid and acid derived from other sources is becoming more and more uncertain. The statistics that I offer are to be regarded, therefore, as more valuable for comparative purposes than as indicative of precise results, although in the latter respect they are probably not far out of the way.

STATISTICS OF SPELTER-SULPHURIC ACID WORKS

(In Tons of 2,000 Lb.)

	1912	1913	1914	1915	1916
Ore received	287,205	364,741	434,666	614,565	705,762
Spelter produced	127,655	148,188	196,529	244,252	271,245
Sulphuric acid, basis 60 deg.	262,555	305,167	355,424	475,740	642,311

It is to be remarked that no attempt should be made to determine from the accompanying statistics any ratios between ore received and sulphuric acid produced or between spelter produced and sulphuric acid produced, for the reason that certain concerns received and smelted a good deal of calamine, which of course never went through the blende-roasting department at all.

ZINC-SMELTING CAPACITY OF THE UNITED STATES

(Number of Retorts at End of Years)

Name	Situation	1915	1916
American Spelter Co.	Pittsburg, Kan.	896	(b) 896
American Steel & Wire Co.	Donora, Penn.	3,648	9,120
American Zinc and Chem. Co.	Langeloth, Penn.	3,648	7,296
American Zinc Co. of Ill.	Hillsboro, Ill.	4,000	4,864
American Zinc, Lead and Smg. Co.	Dearing, Kan.	4,480	4,480
American Zinc, Lead and Smg. Co.	Caney, Kan.	6,080	6,080
Arkansas Zinc and Smelting Corpn.	Van Buren, Ark.	.....	2,400
Athletic Min. and Smelting Co.	Fort Smith, Ark.	.....	(h)
Bartlesville Zinc Co.	Bartlesville, Okla.	5,184	7,488
Bartlesville Zinc Co.	Blackwell, Okla.	.....	8,800
Bartlesville Zinc Co.	Collinsville, Okla.	10,080	13,440
Chanute Spelter Co. (a)	Chanute, Kan.	1,280	1,280
Cherokee Smelting Co.	Cherokee, Kan.	896	(i) 896
Clarksburg Zinc Co.	Clarksburg, W. Va.	3,648	3,648
Collinsville Zinc Co.	Collinsville, Ill.	(b) 1,536	1,984
Eagle-Picher Lead Co.	Henryetta, Okla.	.....	3,000
Edgar Zinc Co.	Carondelet, Mo.	2,000	2,000
Edgar Zinc Co.	Cherryvale, Kan.	4,800	4,800
Fort Smith Spelter Co.	Fort Smith, Ark.	.....	2,560
Granby Mining and Smg. Co. (j)	Neodesha, Kan.	3,760	3,760
Granby Mining and Smg. Co. (j)	E. St. Louis, Ill.	3,220	4,864
Grasselli Chemical Co.	Clarksburg, W. Va.	5,760	5,760
Grasselli Chemical Co.	Meadowbrook, W. Va.	8,592	8,544
Grasselli Chemical Co.	Terre Haute, Ind.	.....	(h)
Hegeler Zinc Co.	Danville, Ill.	3,600	5,400
Henryetta Spelter Co.	Henryetta, Okla.	600	3,000
Illinois Zinc Co.	Peru, Ill.	4,640	4,640
Iola Zinc Co.	Concreto, Kan.	660	(b) 660
Joplin Ore and Spelter Co.	Pittsburg, Kan.	1,440	(k) 1,792
J. B. Kirk Gas and Acid Co. (c)	Iola, Kan.	3,440	3,440
Kusa Spelter Co.	Kusa, Okla.	3,710	3,720
La Harpe Spelter Co.	Kusa, Okla.	(g)	4,000
Lanyon Smelting Co.	Pittsburg, Kan.	448	448
Robert Lanyon Zinc and Acid Co.	Hillsboro, Ill.	1,840	3,200
Lanyon-Starr Smelting Co.	Bartlesville, Okla.	3,456	3,456
Matthiessen and Hegeler Zinc Co.	La Salle, Ill.	6,168	6,168
Mineral Point Zinc Co.	Depue, Ill.	9,068	9,068
Missouri Zinc Smelting Co.	Rich Hill, Mo.	.....	(k) 448
National Zinc Co.	Bartlesville, Okla.	4,260	4,970
National Zinc Co.	Springfield, Ill.	3,200	3,800
Nevada Smelting Co.	Nevada, Mo.	672	672
New Jersey Zinc Co. of Penn.	Palmerton, Penn.	6,720	7,200
Oklahoma Spelter Co.	Kusa, Okla.	(g)	(k) 1,600
Owen Spelter Co. (f)	Caney, Kan.	1,280	1,920
Pittsburg Zinc Co. (a)	Pittsburg, Kan.	910	910
Prime Western Spelter Co.	Gas City, Kan.	4,868	4,866
Quinton Spelter Co.	Quinton, Okla.	.....	1,340
Sandoval Zinc Co.	Sandoval, Ill.	896	672
Tulsa Fuel and Manufacturing Co.	Collinsville, Okla.	6,232	6,232
United States Smelting Co.	Altoona, Kan.	3,960	4,600
United States Smelting Co.	Checotah, Okla.	.....	4,480
United States Smelting Co.	La Harpe, Kan.	1,924	1,926
United States Zinc Co. (l)	Henryetta, Okla.	.....	1,200
United States Zinc Co. (e)	Sand Springs, Okla.	5,680	8,000
United States Zinc Co.	Pueblo, Colo.	2,208	1,984
United Zinc Smelting Corpn.	Moundsville, W. Va.	.....	(h)
Weir Smelting Co.	Weir, Kan.	(g)	448
Totals		155,388	222,326

(a) Operated by American Metal Co. in 1915. (b) No report received; entered the same as previous year. (c) Taken over by U. S. Smelting Co. in July, 1915. (e) Formerly Tulsa Spelter Co. (f) Operated by American Zinc, Lead and Smelting Co. (g) Was under construction in 1915. (h) Under construction. (i) Idle. (j) Subsidiary of American Zinc, Lead and Smelting Co., 1916. (k) Idle latter part of 1916. (l) Formerly Western Spelter Co.

Smelting Capacity—The capacity of the zinc-smelting works of the United States at the end of 1916 is given in the accompanying table, which shows an increase in the total number of retorts of more than 40% as compared with the end of 1915. This statement falls short of measuring the real increase of zinc producing capacity, for it takes no account of the electrolytic plants. The era of mushroom zinc smelting construction drew toward a close. At the end of 1916 there were under construction only the plants of the Athletic Mining and Smelting Co. and those of the Grasselli Chemical Co. at Terre Haute, Ind., and of the United Zinc Smelting Co. at Moundsville, W. Va., the latter two being coal-smelting plants. At Park City, Utah, and at Kennett, Calif., electrolytic plants were being built.

At the end of 1916 the listed smelters of the United States possessed a total of about 222,300 retorts, and the whole number thereof, except about 4730, was reported in use at the end of 1916. Reckoning a production of 4.2 tons of spelter per annum per retort, which was formerly adopted as a factor, the producing capacity at the end of 1916 was 933,600 tons, or 233,400 tons per quarter. The actual production in the fourth quarter of 1916 was 181,076 tons. Assuming that an average of 200,000 retorts was in use during that quarter, the average per retort figures 0.90 ton, or at the rate of 3.60 tons per annum, which is a good deal less than the figure of 4.2 that used to be reckoned. However, it is common knowledge that at the present time the extraction of zinc from a given grade of ore is materially lower than it used to be, and greater inefficiency of labor in other respects reduces the effective work per retort.

At the end of 1916 new furnaces, comprising 14,108 retorts, were reported as being in process of construction, the corresponding figure at the end of 1915 being 23,234.

Imports and Exports—The imports and exports of ore, spelter and sheet zinc are given in an accompanying table, the figures of which require no explanation. It will be observed that the Government figures for the exportation of spelter are different from those representing the production of spelter in bond as reported by the smelters; also that there are discrepancies with respect to the importation of ore. These differences are in part explained by the difference of the periods comprised within the respective reports, the smelters reporting the spelter when it leaves their works and the Government reporting it when it is entered for export in the custom house. In 1916 the smelters reported the production of 94,626 tons of spelter in bond, of which 75,602 tons was exported, while the Government reported the exportation of only 43,229 tons of foreign origin. A portion of this difference is to be attributed to spelter that was piled up on the docks awaiting exportation. However, it must be said that the Government figures for the exports of spelter are under considerable suspicion. In 1915 a terrific mistake with respect to the exportation of sheet zinc was made, a good deal of spelter being apparently included therewith. Upon this being drawn to the attention of the Bureau of Foreign and Domestic Commerce, of the U. S. Department of Commerce, reference to the original returns was made and corrected figures were published in the "Monthly Summary of Foreign Commerce," but I feel confident that even the corrected figures are in error. However, the Division of Statistics of the above bureau traced this thing back as far as it could and its figures must remain as last stated. The errors probably do not appear in the statistics for the latter half of 1916.

IMPORTS AND EXPORTS, BY QUARTERS

		1914	
Imports	Ore, Long Tons	Spelter, Lb.	Dust, Lb.
I	3,355	500,253	1,288,249
II	4,727	512,123	1,256,259
III	6,849	664,012	535,471
IV	13,607	83,191	1,524,128
Year	28,538	1,759,579	4,604,107
Exports	Ore, Long Tons (c)	Spelter, Lb. (a)	Dross, Lb.
I	2,883	842,465	572,477
II	4,297	872,511	0
III	1,319	48,177,681	1,239,570
IV	1,421	90,591,936	3,259,020
Year	9,920	140,484,593	5,071,067
		1915	
Imports	Ore, Long Tons	Spelter, Lb.	Dust, Lb.
I	14,909	480,949	502,008
II	44,449	496,601	316,073
III	33,863	461,957	355,431
IV	48,611	369,457	538,861
Year	141,832	1,808,964	1,712,373
Exports	Ore, Long Tons (c)	Spelter, Lb.	Zinc Sheet, Lb
I	0	83,313,386 (a)	(e)
II	605	56,829,272 (a)	(e)
III	108	39,528,063 (b)	12,929,438
IV	30	58,318,807 (b)	11,836,786
Year	743	237,989,528	24,766,224
		1916	
Imports	Ore, Long Tons	Spelter, Lb.	Dust, Lb.
I	110,293	435,896	779,253
II	98,497	492,823	477,425
III	74,855	243,186	273,899
IV	60,966	196,655	337,125
Year	344,611	1,368,560	1,867,702
Exports	Ore, Long Tons	Spelter, Lb. (b)	Zinc Sheet, Lb.
I	.....	66,840,110	7,174,116
II	30	77,305,196	3,748,914
III	40	109,035,195	12,520,350
IV	.....	124,746,751	11,179,026
Year	70	384,230,412 (d)	28,501,869 (d)

(a) Includes zinc in sheets. (b) Does not include zinc in sheets, which was reported separately from July 1, 1915. (c) In addition to the exports of ore here reported, there were exported ore and calamine of foreign origin, the zinc content of which amounted to 279,000 lb. in 1914 and 1,218,500 lb. in 1915. (d) The quarterly figures do not foot up to the total given. Both are from the report of the U. S. Dept. of Commerce, and the difference is probably due to corrections made after the monthly figures were published, of which we have no knowledge. (e) Included with spelter.

In addition to the figures given in the tables which accompany this article, the following data are of interest: The zinc content of ore imported in 1915 was 57,668 short tons, whereas, in 1916, it was 148,146 short tons. In 1915 the United States exported 4166 tons of zinc dross, but in 1916 only 48 tons of that byproduct was shipped abroad.

Prices—At the beginning of 1916 the price for common spelter was about 16c., St. Louis. During January and February there was a secondary advance, the price for prompt spelter touching 20½c. This was short-lived, however, and early in March the market became weak with pressure to sell from many quarters, and during May there were signs of something like demoralization. In August large tonnages were sold at 7¾@8c. Thereafter there was a third advance, the price rising to 13c. in November, but at the end of December the market was down again to about 9¼c. Around the latter figure it seemed to have come into equilibrium under existing conditions of increased cost of production, etc.

The behavior of the zinc market throughout 1915 and 1916 was absolutely true to economic form. First, there was a fantastic advance, then a decline; next an advance, but not to so high a level as the first one, this being followed by a decline to a lower level. Thus things continued, each advance being a little less and each decline a little more, advances being analogous to the sucessive bounds of a rubber ball until finally the elasticity is spent, and the market rested on the level of the economic conditions of the time, with an accumulated stock of unsold metal as a balance wheel.

The price for high grade spelter, which was as high as 40c. per lb. in 1915, got down to as low as 16c. per lb. in 1916. The prices for intermediate and brass special declined proportionately. These declines represented a great contraction in the premium over the price for common spelter, such contraction being, of course, the perfectly normal thing.

Bonded Spelter—In 1916 there was produced 94,626 tons of spelter in bond. In 1915 the production in this

way was 15,781 tons; in 1914, it was 5630 tons; in 1913, 5904 tons; in 1912, 10,879 tons, and in 1911, 9598 tons.

Zinc Dust—The production of commercial zinc dust in 1916 was 2318 tons, as compared with 1443 tons in 1915, 1042 in 1914, 423 in 1913, 492 in 1912 and 254 in 1911. In 1913 only two smelters were engaged in this manufacture, but when the outbreak of the war in 1914 cut off America's foreign supply and the price rose from about 6c. per lb. to 15@16c., several additional smelters engaged in the manufacture of it.

The importation of zinc dust was 934 tons in 1916, compared with 856 tons in 1915, 2302 in 1914, 2200 in 1913, 2400 in 1912 and 1713 in 1911.

Large Producers—A particularly interesting feature of the zinc business in recent years has been the entry of several general metallurgical companies into this field. We mean companies that are engaged in the production of other metals and have begun the production of spelter as a new feature of their business. Inasmuch as several of these companies make public reports, their outputs in tons in 1916 and 1915 may be stated as follows, the figures for 1916 being given first and those for 1915 in brackets immediately following: United States Steel Corporation, 55,898 (32,031); American Smelting and Refining Co., 23,904 (18,077); United States Smelting Co., 32,292 (17,052).

Production of Zinc in Foreign Countries—Statistics of the production of zinc in foreign countries are available only to a slight extent. We know that strenuous efforts to increase the output have been made in several countries, but in only one or two cases do we have exact statistical information. Without any doubt, Japan has made the most rapid strides. Its output in 1916 was about 50,000 tons, compared with 22,314 tons in 1915 and 6481 in 1914. The production of zinc in Great Britain has also increased, and is destined to increase still further, several important plants being under construction there. The large smelter at Ekibastus, Siberia, began to produce spelter in 1916, but did not make very much. There was also delay in completing the new plant of the Societa di Monteponi in Italy. However, both these plants will probably be in operation in 1917. Although the expansion in zinc production in other parts of the world has not been on so huge a scale as in the United States, nor is it likely to be, nevertheless, such as there is plays an important part in reducing the demands of foreign users upon our supplies.

Consumption—An effort was made to report the consumption of zinc in the United States in 1916, for which purpose a list of consumers—317 in number—was asked to state the amount of their *use*, not *purchase*, of the metal according to principal purposes. The responses to this inquiry were very good, 170 consumers making returns. We failed to receive reports from the concerns given in the accompanying list, against whose names are entered their estimated consumption, which figures must be used in order to get any totals.

In addition to the above, there were 109 small consumers on our list whose use of zinc in 1916 we estimated as having aggregated 26,150 tons.

Our totals will be in error according to errors in the above estimates, according to omissions from the list of 317 consumers, which probably does not include all the small consumers of the United States, and according to the mistakes by misunderstanding or otherwise made by the concerns that furnished reports. In a general way, it may be assumed that our list of 317 consumers, which does not include lead desilverizers, comprises nearly all of the zinc consumers of the United States that used as much as 20 tons of zinc per month.

Before entering upon any statement and discussion of these returns, it will be interesting to compare with a rough estimate on this subject that was made in the *Engineering and Mining Journal* of Dec. 2, 1916, as follows:

"Before attempting to account for the disposition of the present production of spelter, let us try to account for what became of the output in the first six months of 1916. The production during that period, officially reported, was 316,255 tons. The exports were 78,204 tons. The domestic deliveries were 228,700 tons. Domestic deliveries averaged 38,000 tons and exports 13,000 tons per month, a total of 51,000 tons per month.

LARGE SPELTER CONSUMERS WHO DID NOT REPORT

Company	Estimated Quantity, Tons	Purpose
Ball Bros.	7,000	Galvanizing
Brier Hill Steel Co.	6,000	Galvanizing
Buffalo Copper & Brass Roll. Mills	20,000	Brass Making
Cambria Steel Co.	1,400	Galvanizing
Chase Rolling Mill Co.	15,000	Brass Making
Detroit Copper & Brass Co.	9,600	Brass Making
Gilbert & Bennett	600	Unclassified
Kelly & Jones	600	Unclassified
Lalance & Grosjean	900	Unclassified
Landers, Frary & Clark	600	Brass Making
Manhattan Brass Co.	1,200	Brass Making
Mark Manufacturing Co.	4,500	Brass Making
Michigan Copper & Brass Co.	3,600	Brass Making
Michigan Smelting & Refining Co.	1,200	Brass Making
Monumental Bronze Co.	600	Castings
Moore-Jones Brass Co.	600	Brass Making
National Conduit & Cable Co.	6,000	Brass Making
New England Enamel Co.	600	Unclassified
Parksburg Iron & Steel Co.	2,400	Galvanizing
Reading Iron Co.	1,500	Galvanizing
Scaife, Wm. B., & Co.	1,200	Galvanizing
Standard Oil Co.	600	Unclassified
Stark Rolling Mill Co.	7,000	Galvanizing
Youngstown Iron and Steel Co.	450	Galvanizing
Youngstown Sheet and Tube Co.	12,000	Galvanizing

" In accounting for the use of this spelter, there is available certain definite information, but to a considerable extent we must depend upon conjecture. We have definite information respecting the exports of spelter and of brass in bars and plates. Manufactures of brass exported are also reported, but only in terms of value. We may compute approximately the quantity by dividing by the average price for brass plus an advance representing manufacture. Let us add 10c. per lb., which is probably a low figure. We can approximate the consumption for galvanizing and sheet zinc from information communicated by the galvanizers and rollers. As to brass for domestic peaceful purposes, the figure must be chiefly conjecture. Before the war it used to be 20 to 25% of the total consumption of spelter, the latter being about 300,000 tons per annum. Reckoning 25% of 300,000, we get 7500. Our estimated distribution of the monthly delivery of spelter in the first half of 1916 is as follows:

	Tons
Exports	13,000
Galvanizing	13,000
Sheet	4,000
Domestic brass	7,500
Brass exported in bars, etc.	3,000
Brass manufactures exported	7,200
Lead desilverization	400
Castings, etc.	1,250
Unaccounted for	1,650
Total	51,000

"Since the middle of the year two very striking things have occurred—the exports of spelter in slabs, etc., have

increased to about 16,000 tons per month, while the exports of brass manufacturers have increased to a probable 12,200. We state these figures on the basis of the average monthly exportation during the third quarter. The exportation of brass bars declined slightly. Employing these figures, together with those for other uses at the same rate as in the first semester, we get a probable delivery and distribution per month at the present time approximately as follows:

	Tons
Exports	16,000
Galvanizing	13,000
Sheet	4,000
Domestic brass	7,500
Brass exported in bars, etc.	3,000
Brass manufactures exported	12,200
Lead desilverization	400
Castings, etc.	1,250
Unaccounted for	1,650
Total	58,800

"It is to be remarked that one kind of present consumption cannot be accounted for quantitatively; namely, the brass that goes into cartridges, the exportation of which is reported under the heading of "Explosives," and as the finished article in terms of value only.

"Our estimate of spelter for brass manufacture totals 22,500 tons per month, corresponding with 45,000 tons, or 90,000,000 lb. of copper, which is just about what authorities in the copper trade estimate for the total copper delivery to brass manufacturers at present."

The aggregate of the reports by consumers (including the estimates previously explained) for the use of spelter in 1916 is as follows:

	Tons
Galvanizing	207,849
Sheet	40,053
Brass	175,435
Castings	2,359
Desilverizing lead (*a*)	5,307
Other purposes	4,351
Unclassified	14,950
Total	450,304

(*a*) Estimated on basis of lead desilverized.

In order to disarm criticism let me say at once that the above figures do not look just right. The total of deliveries by smelters, computed from stocks at beginning of the year, plus production, less exports and stocks at the end of the year, was 489,787 tons in 1916. Now, that is not an absolute figure to which to tie. Spelter that had left the works, destined for export, might have been locked up in railway cars in transit and might have been piled up on the docks to an extent that would make domestic deliveries, or what is statistically classed as such, appear very much less if it could have been taken into account. On the other hand, the larger part of the dross and scrap that is resmelted and resold is not included in the above report of production and the total supply available for consumption would be increased by just so much.

The production of zinc redistilled from dross by junk smelters in 1916 was about 18,000 tons. In addition thereto there was a considerable production of remelted spelter. The statistical treatment of these subjects is so complex that it would be unsafe to say more on the subject than that there is available for consumption a considerable tonnage of spelter in excess of what is indicated by the deliveries by primary smelters.

Turning to the reports by consumers, the figures for galvanizing, sheet-zinc rolling and lead desilverization look about as they ought to. Galvanizing is indeed considerably ahead of the rough estimate of last December. Sheet zinc is a little under, but it was supposed that this had been overestimated. In the present report the consumption of zinc for castings and miscellaneous purposes is probably understated. The consumers in those classes are generally small concerns and it is likely that there were omissions from the list. However, it is hardly to be supposed that such omissions would make any great difference in the grand total.

The place of trouble is manifestly with the reports of the brass-makers. These reports comprised all of the important brass-makers except those whose figures have been estimated as mentioned previously. It is likely that some small brass-makers, using individually, a few hundred tons of zinc per annum, have been overlooked. But they will not account for the difference.

In the estimate of Dec. 2, 1916, it was said that the total for brass manufacture was reckoned at 22,500 tons per month, corresponding with 45,000 tons, or 90,000,000 lb. of copper, "which is just about what authorities in the copper trade estimate for the total copper delivery into brass manufacture at present." It is to be noted, however, that this is for the last half of the year, during which the brass trade experienced a great expansion. In the first half of 1916 the consumption of zinc for brass-making was at a lower rate, but nevertheless was estimated at 17,700 tons per month. My present statistical accounting for the year shows an average of a little less than 15,000 tons per month for brass-making.

There was published toward the end of 1916 a statement of the consumption of copper by all of the principal concerns at that time, the monthly rate being given and the annual rate being computed by multiplying by 12. Estimating that brassmakers use on the average about half as much zinc as copper, we may translate the statement into terms of zinc, but referring to the individual reports to us none of the brass-makers actually used so much zinc in 1916 as he was supposed to be using on the basis of the estimate near the end of the year.

It is well known that at the end of 1916 there was unusual congestion on the railways and that a larger quantity of zinc, as well as of lead and copper, was in transit than at the beginning of the year. That, together with spelter piled up on the docks for export, accounts for statistics of actual consumption being less than appears from smelters' deliveries. When we say "actual consumption" we mean what was reported by the consumers. Whether their returns represent actual consumption, or what was received at their works, or what was purchased, is another matter. Probably there is a mixture of all those conditions. Some large consumers of metals do not keep their books in a way that will show actual consumption year by year. This does not, of course, refer to all, but it indicates one more of the difficulties of a statistical investigation of this kind.

The only conclusions that I feel may be safely drawn from these statistics are the following:

1. The production of zinc in the United States was 683,000 tons in 1916.

2. The exports were 192,000 tons.

3. The domestic consumption was somewhere in the neighborhood of 450,000 tons.

4. The consumption for galvanizing was more and for brass-making was less than was estimated during 1916.

5. Although the stock in smelters' hands increased by only about 2000 tons, there was in reality a large increase of stock, which, however, was unavailable owing to delays in transit and did not become released until 1917. Consumers then obtaining possession of what they had previously bought were able to reduce their buying and stocks began to pile up in smelters' hands. The behavior of the zinc market during the first half of 1917 has been the natural reflection of these conditions.

Industrial Poisoning in the Manufacture of Explosives

"Industrial Poisons Used or Produced in the Manufacture of Explosives," is the title of a bulletin just issued by the United States Bureau of Labor Statistics. Forty-one factories in the East were visited by Dr. Alice Hamilton, in 1916, in which about 90,000 workers were employed, of whom approximately 30,000 were doing work exposing them to poisons. Practically no women, girls or boys were among this number. This is a matter that merits greater attention, in the interest of public welfare, than has been granted it during the past three years. Attention has been focused upon filling contracts and in many cases little heed has been paid to the health risks involved.

The explosives manufactured in these factories were nitrocellulose, or nitrocotton, including pyroxylin and military guncotton; smokeless powder; picric acid and ammonium picrate; nitroglycerin and dynamite; trinitrotoluol, or TNT or triton; fulminate of mercury; tetranitraniline, or TNA; tetranitromethylanilin, or tetryl; nitronaphthalenes; and ammonium nitrate. Their production involves the use of nitric acid, sulphuric acid, benzol and toluol, anilin oil, chlorbenzol and dinitrochlor benzol; phenol or carbolic acid, sulphuric ether, mercuric nitrate, and amyl acetate. In the course of manufacture certain poisons are evolved as the result of chemical reactions, these being oxides of nitrogen, or nitrous fumes, sulphur dioxide, chlorine gas and ethyl nitrite.

In this industry there is a very high labor turnover, instanced by the fact that in one plant it was necessary to employ about 4000 men during 13 months to keep up a force of 200. On the whole, wages are high and living conditions poor. In most of the plants the men work three eight-hour shifts; two shifts is the exception.

It was impossible to obtain accurate figures as to the amount of sickness and death caused by work in this industry since the war broke out. Many cases were never recognized; others were noted by company physicians or insurance physicians who were unwilling to give any information concerning them; in some factories there was either no medical care or it was inadequate; in others records were so incomplete as to render the data somewhat misleading. Based, however, upon physicians' reports only, although information as to other cases was obtained, it was found that in 28 plants, in the space of about one year, there were 2507 cases of industrial poisoning, of which 75 were women. Of the total number of cases 53 were fatal, 2 of these being women. About 55% of the total cases and 53% of the fatal cases were caused by nitrogen oxides and nitric acid, while 28% of all cases and 25% of the fatal cases were due to trinitrotoluol, or TNT, which is manufactured and made into charges for high-explosive shells.

The reason nitrogen oxide poisoning, or "fume sickness," heads the list is that all these explosives are produced through processes of nitration in which a mixed acid is used, one of the ingredients being sulphuric acid and the other 100% nitric acid. The higher the nitration the greater the danger from fumes. The 1300 to 1400 men who suffered from these fumes were employed in making nitrocellulose or nitrocotton, picric acid or trinitrophenol, the nitrotoluols, nitrobenzols, nitronaphthalenes, nitroglycerin, and the nitric acid needed for these processes.

Another extremely dangerous process is the filling of shells with trinitrotoluol (TNT), either by pressing, which is very dust productive, or by molding, which involves fumes.

Aluminum Company of America

The *Boston News Bureau* has obtained data of the Aluminum Company of America, whose operations have heretofore been a closed book to the public, showing that the company did a gross business of $25,940,427 in 1916 from the sale of 86,589,774 lb. of aluminum at an average price of 29.96c. per lb. In addition the company supplied to its subsidiary, the United States Aluminum Co., 24,821,061 lb. of aluminum which was fabricated by the latter concern.

About 300 persons own the $20,000,000 outstanding capital stock of the Aluminum company, a large number being employees. At the time of his death a few years ago, Mr. Hall, owning the patents which formerly controlled the process of manufacture, held about one-quarter, or $5,000,000 of the total. Bids of $700 a share have been unsuccessful in bringing out holdings, although the company pays only 10% dividends. A nominal market now exists in New York at $700 bid, $800 asked.

The following, never before published, shows issued capital and dividends paid since the company was formed in 1890:

Year Ended	Auth. Cap.	Div.	Year Ended	Auth. Cap.	Div.
Aug. 31, 1889–1894	$1,000,000	...	Aug. 31, 1905	$3,800,000	6%
Aug. 31, 1895	1,000,000	4%	Aug. 31, 1906	3,800,000	11
Aug. 31, 1896	1,000,000	6	*Dec. 31, 1906	3,800,000	3.37
Aug. 31, 1897–1898	1,000,000	...	Dec. 31, 1907	3,800,000	11
Aug. 31, 1899	1,600,000	4½	Dec. 31, 1908	3,800,000	1
Aug. 31, 1900	1,600,000	8½	Dec. 31, 1909	20,000,000	.20
Aug. 31, 1901	1,600,000	7½	Dec. 31, 1910–'13	20,000,000	4
Aug. 31, 1902	1,600,000	8½	Dec. 31, 1914	20,000,000	6
Aug. 31, 1903	1,600,000	7½	Dec. 31, 1915	20,000,000	6½
Aug. 31, 1904	1,600,000	6	Dec. 31, 1916	20,000,000	10

* Four months ended Dec. 31.

The Aluminum company has capacity for producing 155,000,000 lb. of aluminum annually in the United States and 20,000,000 lb. a year in Canada, a total of 175,000,000 lb. With no importations since the outbreak of the war, this company has been called upon to furnish the entire requirements of America, whereas formerly 40% of the requirements here was imported from France and England.

For 1918 delivery the Aluminum Company of America has named 37c. per lb. as its price, although it has sold as high as 60c. per lb. The April average was 35c.

Although capitalized for but $20,000,000, the Aluminum company has a plant investment of over $80,000,000, the difference representing today's surplus. Approximately $70,000,000 of undivided profits has gone back into the property since the company was organized.

Bureau of Mines To Increase Its Activity

Since 1910 the Bureau of Mines has been operating eight mine-rescue cars, each having headquarters in some one of the more important mining districts of the United States. The majority of these cars are operated in coal-mining districts; only one car, in fact, is operated in a metal-mining district exclusively, and that is in the Lake Superior iron and copper district. These cars were old Pullmans remodeled to meet the requirements of a mine-rescue car.

Some time ago Congress authorized the construction of additional all-steel cars for the mine-safety service of the Bureau of Mines, three of which have just been delivered and will take the place of three of the old cars, which were condemned a short time since as being unfit for further use. These cars will be sent to the Far West, with headquarters at Reno, Nev.; Raton, N. M.; and Butte, Mont., respectively.

It is to be especially noted that this marks the beginning of more extensive activities in metal-mining districts than it has been possible to undertake in the past.

Each of the three cars is identical in construction. The floor plan consists of:

A. Demonstration room, in which is stored all the oxygen mine-rescue apparatus, first-aid materials and accessories.

B. A corridor leading along one side of the car from the demonstration room to the rear end.

C. The first compartment off the corridor is the foreman's stateroom, which has berths and lockers for four men.

D. The second compartment is the bathroom, provided with toilet and bathing facilities, including a shower bath.

E. A third compartment is the engineer's office, in which are two desks, bookcases, and berths and lockers for three men.

F. A fourth compartment consists of a dining room provided with linen closet, center table and chairs, etc. In one corner is a typewriter desk which the clerk will make his office.

G. A fifth compartment consists of the cook's stateroom and separate toilet.

H. The sixth compartment is fitted up as an up-to-date car kitchen with range, ice chest, lockers, etc., and the regulation funnel arrangement and exhaust fan in the roof for ventilation purposes. A double-coil Baker heater system is in the kitchen end of the car.

The car is of all-steel construction and each compartment and the demonstration room are fitted with electric fans. There is a generating set in the demonstration room for generating the electric power, in other words, the car provides its own light and heat. A feature is that a place has been provided in the car for every piece of apparatus.

The rescue apparatus consists of 10 sets of oxygen mine-rescue apparatus, oxygen pump and oxygen-storage cylinders, mine-rescue lamps, life lines, etc. The first-aid equipment consists of first-aid cabinets, bandages, splints, surgeon's emergency chest, stretchers, etc., and to supplement the manual (Schaefer) system of resuscitation of those overcome by poisonous gases, there is provided a simple mask with relief valve and connection for attachment to an oxygen bottle.

The engineer's equipment consists of every feasible device for the examination of mines as to sanitation, efficiency and safety, including Orsat apparatus for analyzing mine gases, vacuum air sample tubes, barometer, sling psychrometer, anemometer, surveying compass, Haldane air tester, ore- and coal-sampling outfits, camera, etc. The cars are expected to operate 10 months out of each year.

The duty of the mining engineer is to arrange tentative itineraries of training through coöperation of the different parties concerned, to supervise the general operations of the car, to study the different safety, sanitary and efficiency features in the mines and to spread new ideas regarding those features from one camp to another. The foreman miner is to instruct classes of miners in the use of the oxygen mine-rescue apparatus and mine-rescue and fire-fighting work in general. The first-aid miner is to teach classes of miners in first-aid methods and how to move injured men. The clerk will take care of all the clerical and stenographic work on the car. The cook will also care for the living quarters.

The hearty coöperation of mine officials, state mine inspectors, labor officials and miners is hoped for by the Bureau of Mines, and the car crews will endeavor to work harmoniously with everyone concerned and help propagate the safety-first movement in their respective districts. The methods of working out itineraries in the different districts will have to depend upon the district itself, with due regard paid to the railroad facilities, the season of the year, the wishes of the mine operator, etc.

The Reno car, which will be known as Car No. 1 and which will make its headquarters on the University of Nevada campus at Reno, Nev., is manned by the following crew: Edward Steidle, mining engineer; J. V. Berry, foreman miner; Walter F. Pyne, first-aid miner; D. W. Cooke, clerk, and a cook.

The personnel of Car No. 2, with headquarters at Raton, N. M., is as follows: C. A. Herbert, mining engineer; K. H. Chisholm, foreman miner; James Dalrymple, Jr., first-aid miner; A. F. Goldbloom, clerk.

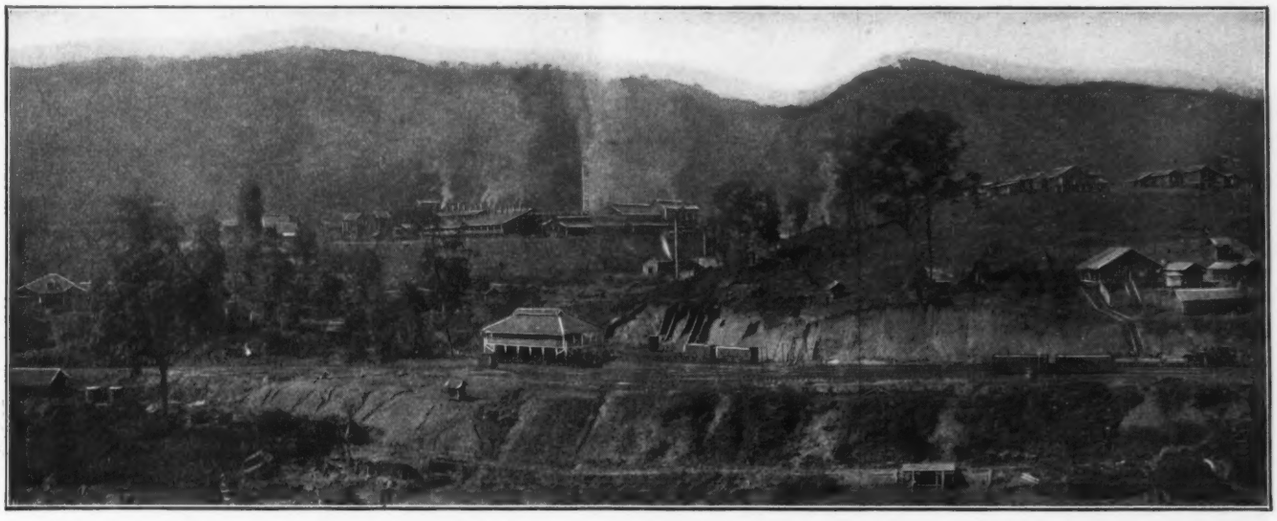
The personnel of Car No. 5, to be stationed at Butte, Mont., is as follows: C. A. Allen, mining engineer; J. J. Forbes, foreman miner; S. C. Dickinson, first-aid miner; S. S. Blum, clerk.

At a later date, in addition to the foregoing, a mine surgeon will be detailed for duty on each of these cars, his work to be carried on in coöperation with the public health service.

Spanish Ore Exports

Exports of iron ore from Spain were 4,509,214 metric tons in 1915, and 5,148,127 tons in 1916, an increase of 638,913 tons. Demand from France and England for high-grade ores has more than made up for the stoppage of shipments to Germany. Exports of manganese ore were 9136 metric tons in 1915, and 6815 tons in 1916; a decrease of 2321 tons. Exports of pyrites were 2,268,223 tons in 1915 and 2,743,487 in 1916; an increase of 475,262 tons.

Lead Smelting at Namtu, Burma

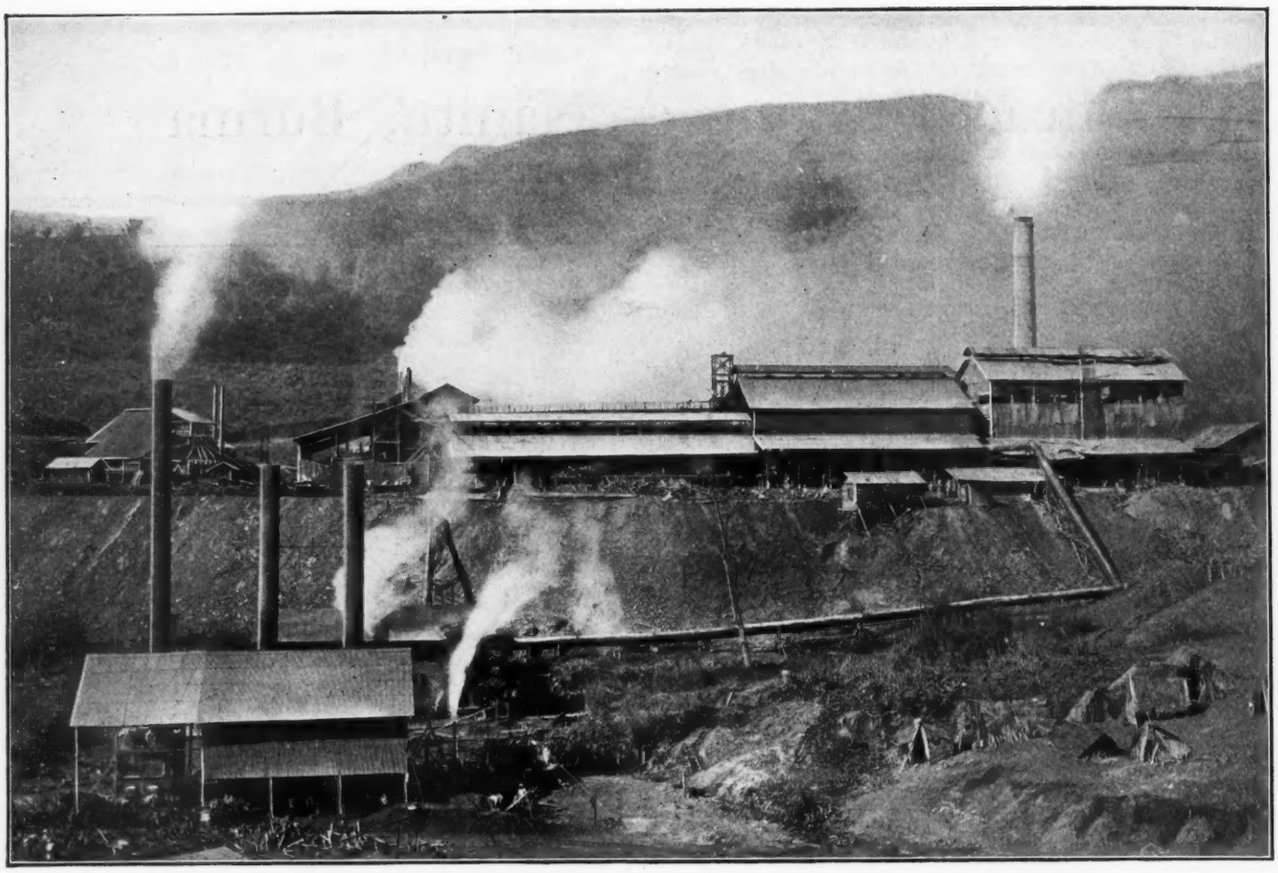


GENERAL VIEW BURMA CORPORATION'S REDUCTION WORKS AT NAMTU, 13 MILES FROM ITS BAWDWIN MINE

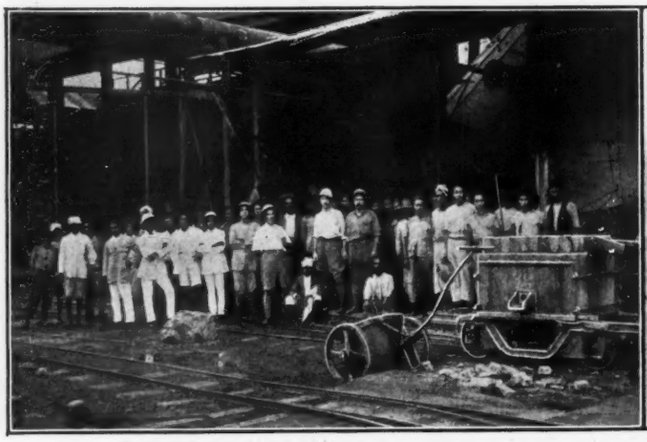
RESIDENTIAL SECTION OF THE SMELTING TOWN OF NAMTU, NORTHERN SHAN STATES, BURMA

A TYPICAL BUNGALOW AT NAMTU

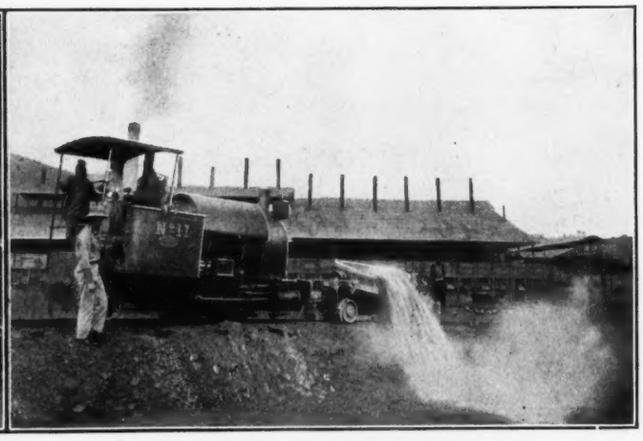
THE NAMTU CLUB FOR STAFF EMPLOYEES



CLOSER VIEW OF THE NAMTU SMELTERY—TEMPORARY POWER HOUSE IN FOREGROUND



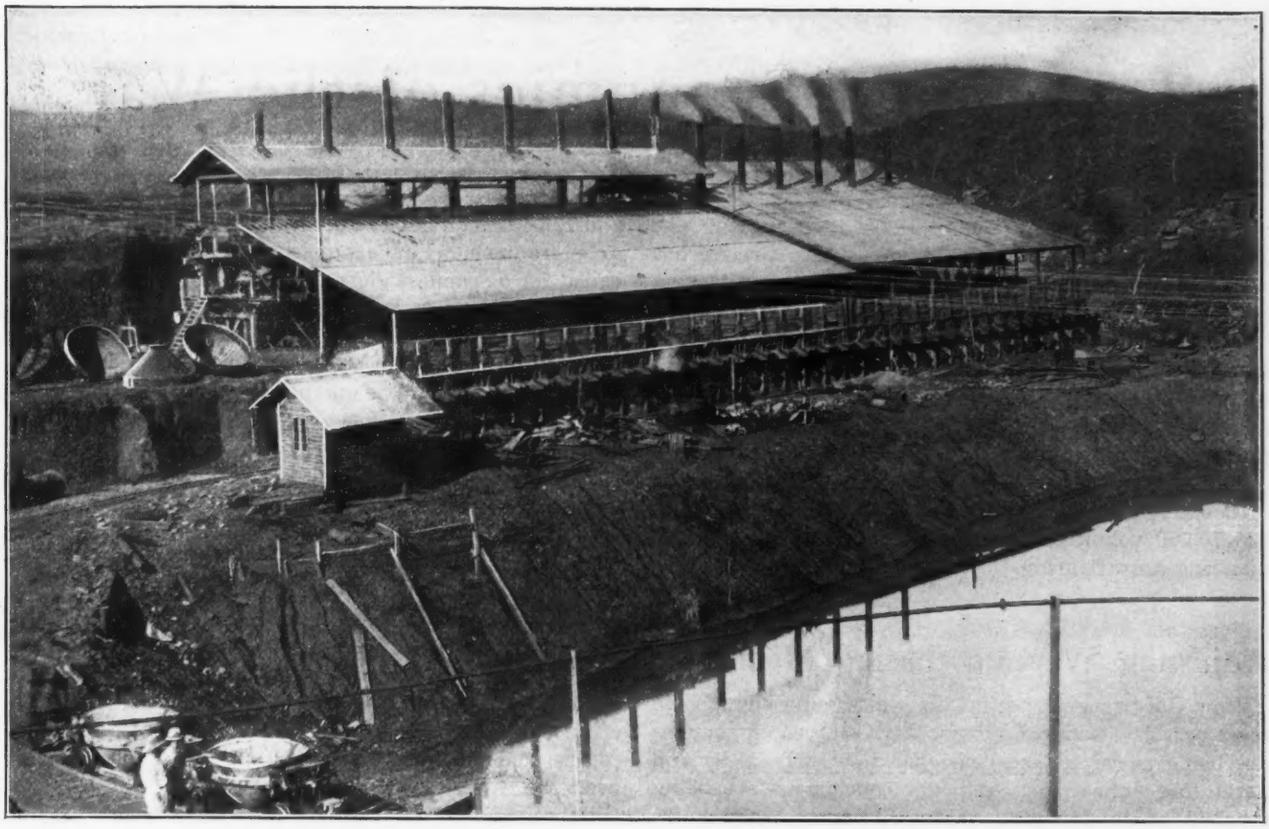
GROUP OF SMELTERY EMPLOYEES



DUMPING BLAST-FURNACE SLAG

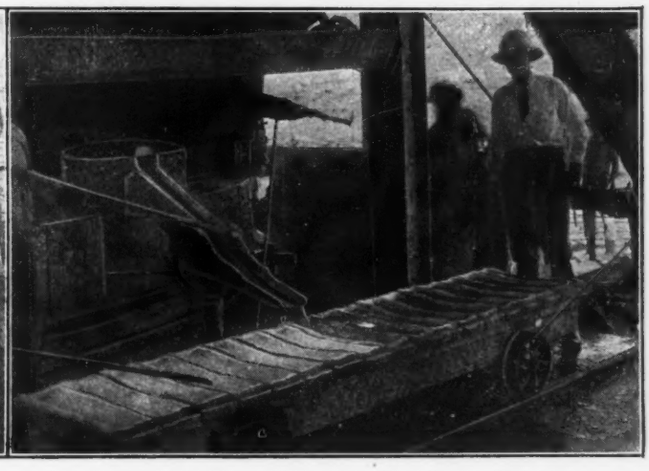
TAPPING REFINED LEAD AT NAMTU

REFINED LEAD READY FOR SHIPMENT

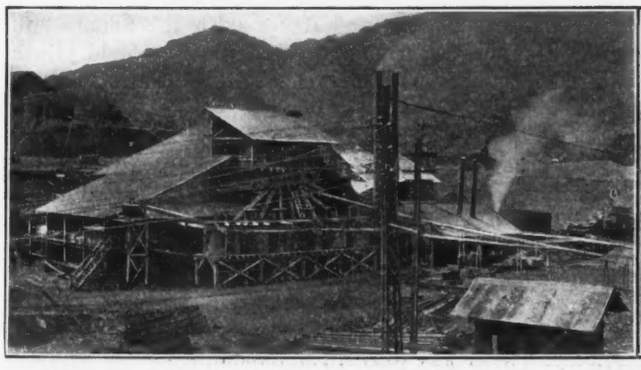


POT SINTERING PLANT AT BURMA CORPORATION'S NAMTU WORKS, UPPER BURMA

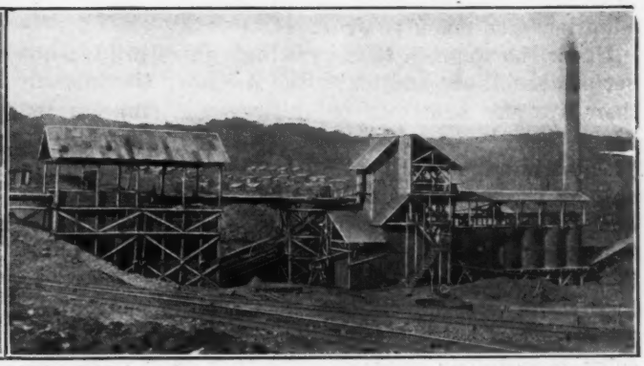
FINISHING A FURNACE TAP



TAPPING LEAD FROM FURNACE CRUCIBLE



EXPERIMENTAL MILL—COMMERCIAL PLANT DESIGNED



AUXILIARY CRUSHING PLANT FOR SMELTING ORE

Events and Economics of the War

An American army has arrived in France. The Russians have renewed their offensive. Greece has broken with the Central Powers thus probably releasing Sarrail's army at Saloniki for a Balkan campaign.

These facts and the news that the Embargo Board has begun its work, coupled with evidence from many quarters that the Defense Council is on its way to achieving great results, invite optimism in spite of the many strikes.

Price fixing and food control remain the chief topics of debate. The Administration's call for and failure to get 70,000 volunteers has strengthened its case in demanding a draft army.

Adjusting War Purchasing Machinery

How Government specifications are being changed to meet practical war conditions; how sources of supplies are being surveyed and developed to satisfy a demand heretofore unheard of; and how conclusions are being reached as to fair and reasonable prices—these are questions gone into in the first of a new series of war bulletins. The series will be issued through the Chamber of Commerce of the United States for the purpose of placing before business men authoritative statements regarding Government activities in procuring materials and supplies for the war.

The first bulletin makes it clear that the Council of National Defense confines itself to investigating, reporting, making recommendations and bringing Government officials in contact with business men. The fact is emphasized that it does not make purchases, issue orders or have any part in carrying them out. It has not the power to do this by law, and does not do it in fact. Notwithstanding all vague opinion to the contrary, the buying is still done by the War and Navy Departments through the several bureaus.

Although constantly confused with the Advisory Commission, the Council is made up of only the Secretaries of War, Navy, Interior, Agriculture, Commerce and Labor. Each member of the Advisory Commission is particularly active in some field—thus Mr. Willard has to do with transportation matters and Mr. Coffin with munitions and manufactures.

Under the Council, it is explained, there are a number of committees and under the Advisory Commission there are also numerous committees, all being for the advice and assistance of the Council. The fact is brought out that for months there have been actively at work in Washington the most competent men in each industry who, without compensation, have been doing their utmost to utilize our vast resources and industries in the prosecution of war.

Effective work has been done in adapting peace-time Government specifications to immediate needs. A difficulty immediately apparent was that they were prepared years ago for our small army in time of peace and fell far short of the present necessities of a million or more men. For example, the glove specifications called for a seamless glove, of which not more than 500,000 could be made by all the equipment in the United States in a year. The men in the trade readily pointed out how by changing the specifications, an equally satisfactory glove could be manufactured by existing equipment in quantities to meet the requirements of millions of men.

At a conference between army engineers and 15 chief engineers representing the principal truck manufacturers of the United States, a standard specification was adopted for trucks for war service and a definite beginning made in standardizing the military truck. Many of the specifications, such as those for projectiles, stated the characteristics of the finished article, but did not specify the material from which such article should be made. New specifications have now been prepared covering all points that should be covered for the effective control and guidance of the manufacturer in producing what the Government wants.

Subcommittees of railroad men have been studying the distribution of motive power on the several railways and the adjustment of passenger and freight service in accordance with the Government requirements. These committees are endeavoring in every way to conserve the car supply and assist the railroads to meet the extraordinary demands made upon them. The pooling of coal at Lake ports with the consequent great saving in car requirements is one of the results. All this is but a small part of what has been accomplished.

Planning for Mastery of the Air

Preparations for the mightiest air offensive ever known, when United States forces get fully into action, are being worked out in Paris, London, Washington and Petrograd.

Commandant de Civrieux writes in the Paris *Matin:* "America's step shows she has grasped the necessities of war. Her immense aërial army will swing the scales in our favor. The Allies are guaranteed complete mastery of the air in the spring by her step, whatever the activity of German aircraft shops during the winter."

Secretaries Daniels and Baker with the Senate subcommittee decided that both departments would jointly draft a bill that will carry the big appropriation and that will also contain an important personnel section. This section is intended to solve the problem of the joint authority of the Army and Navy over aircraft.

Both secretaries said that stress should be laid upon the production of training machines, while plans go forward for a better type of battle plane. It is impossible now to standardize airplanes because of the constant changes discovered to be important. A machine 30 days old is virtually obsolete on the battle front. There are now 10,000 volunteers for aircraft service. The ideal age for aviators is from 18 to 21.

A high ranking officer of the Navy predicts that the principal contribution of the United States to military operations will be the evolution of the entirely new type of fighting airplane. Speed will be sacrificed to weight of broadside and invulnerability, he believes. The armament may be as heavy as one-pounder Navy guns.

"The most that can be claimed for European fighting planes," says Glenn Curtiss, "has been a speed averaging 127 to 135 miles an hour. The Curtiss Aëroplane Co. has now developed a combat triplane and has under way other machines which show a speed of 140 to 145 miles an hour. We are working now on training types of 125-mile speed range."

The Aircraft Production Board, which is under the Council of National Defense, has arranged for the production of 3500 airplanes this year and for the training of 6000 aviators.

This has been accomplished by developing sources of manufacture in those lines of business best fitted by equipment and experience to undertake the production of airplanes and by securing the active assistance of six military engineering universities in the training of aviators. This latter has involved the sending of professors to take instruction at Toronto.

The same board, realizing the need for the development of a standard engine in various sizes, has succeeded in obtaining the coöperation of two of the foremost engine designers in the country, Messrs. Vincent and Hall. The fundamental idea of the engine is a unit cylinder by means of combinations of which any desired power may be obtained. It is proposed at first to build engines in four sizes of 4, 6, 8 and 12 cylinders, the corresponding horsepower being approximately 100, 200, 300 and 400.

The coöperation obtained in the design of this engine has shown the feeling of patriotism throughout the country. Requests were sent out from the foremost engine draftsmen with the various automobile and airplane companies throughout the country, and the volunteers worked night and day without compensation.

The facilities of the Bureau of Standards for the assembly of this engine have been placed at the disposal of the board, as well as the accumulated knowledge of the bureau and its staff of the various metallurgical processes necessary for the completion of the engine.

The development of this engine will in no wise interfere with or retard the development of private manufacturers, but, if anything, should stimulate them to further effort.

The Council's program further calls for an army aviation field completed every 90 days until the nine authorized by Congress are constructed.

Large forces of workmen are engaged in constructing flying fields at Rantoul, Ill., Detroit, Mich., Dayton, Ohio, and Hampton, Va. Contract for the fifth site at Belleville, Ill., has been signed and work is expected to start this week.

Each camp will cost $688,000, with 57 buildings for housing of fliers, machines and appurtenances.

Students applying for commissions in aviation corps will receive two months' training in "ground work" at various universities designated, and then will be sent to the aviation fields for actual work in the air. To every student engaged in flying the signal corps hopes to furnish five carpenters and mechanics.

To Shape French Timber

Recruiting for the rank and file of the "forest" regiment, or the 10th Reserve Engineers (forest), is actively under way. The enlisted men will be picked woodsmen. With only 2000 needed out of the vast number of woods workers which the lumber industry of the United States employs, the selection will be very careful. Trained foresters will officer the regiment.

The regiment will convert available timber behind the battle lines in France into railroad ties, trench timbers, mine props, bridge timbers, lumber and cordwood needed in the military operations of the British army. The work may fall within the danger zone and will be done largely in sprout forests of oak, beech, hornbeam and other hardwoods, with some stands of pine. The timber is small in comparison with most American forests, much of it from 8 to 12 in. in diameter. These forests resemble the woodlots of southern New England, and the operations will be similar to portable sawmill logging and tie cutting in Massachusetts, Connecticut, Maryland and Virginia. The larger logs will be sawn into boards and dimension material, while the smaller trees will be cut into hewn ties, poles, props, etc. The closest possible use of timber will be required.

The French forests have for many years been managed with great care and skill. It is the view of the Government's forestry officials that if the American forest regiment is to do creditable work, it must be able not only to cut and manufacture the timber with high efficiency, but also to avoid waste and leave the forests in good shape for future production. This is the reason for selecting mainly trained foresters as officers.

Maintenance of Existing Standards

There seems to be some misunderstanding of the scope of the statement made by the Council of National Defense when it advised "that neither employers nor employees shall endeavor to take advantage of the country's necessities to change existing standards." In order that that misunderstanding may be removed, the following amplification is made by the Council.

There have been established by legislation, by mutual agreement between employers and employees, or by custom, certain standards constituting a day's work. These vary from 7 hours per day in some kinds of work to 12 hours per day in continuous-operation plants. The various states and municipalities have established specific standards of safety and sanitation and have provided inspection service to enforce the regulations. They have also established maximum hours of work for women and minimum age limits for children employed in gainful occupations. It is the judgment of the Council of National Defense that the Federal, state and municipal governments should continue to enforce the standards they have established unless and until the Council of National Defense has determined that some modifications or change of standards is essential to the national safety; that employers and employees in private industries should not attempt to take advantage of the existing abnormal conditions to change the standards which they were unable to change under normal conditions.

The one other standard that the Council had in mind was the standard of living. It recognizes that the stand-

ard of living is indefinite and difficult to determine, because it is in a measure dependent upon the purchasing power of wages. It believes, however, that no arbitrary change in wages should be sought at this time by either employers or employees through the process of strikes or lockouts without at least giving the established agencies, including those of the several states and of the Government, and of the Mediation Board in the transportation service and the Division of Conciliation of the Department of Labor in other industries, an opportunity to adjust the difficulties without a stoppage of work occurring.

While the Council of National Defense does not mean to intimate that under ordinary circumstances the efficiency of workers is the only element that should be taken into consideration in fixing the hours of labor, safety, sanitation, women's work and child-labor standards, such efficiency is the object that must be attained during the period when the nation's safety is involved. It may, therefore, be necessary for the Council as a result of its investigations and experiences to suggest modifications and changes in these standards during that time.

It is not the purpose of the Council, however, to undertake to determine the wage rate that will be sufficient to maintain the existing standards of living. Such questions as cannot be adjusted by private negotiations should be referred to the mediation agencies previously referred to or to such other constituted agencies as may exist, to the end that such questions may be adjusted in an orderly and equitable manner to avoid the stoppage of industries which are so vital to the interests of the nation at this critical time.

Control of Exports by New Board

President Wilson, by executive order, has created a new export council known as the Embargo Board, which will have complete authority to declare embargoes on exports from this country. It is made up of representatives of the commerce, agricultural and State departments and of the food administration. It will decide all questions of policy relating to exports. It will have power, not only to head off shipments of commodities to the central powers and to neutrals, but also to cut off export of commodities needed at home. Through this powerful weapon the United States will be able to follow the exports from this country all the way to the ultimate consumer.

State Department officials will advise the board as to whether certain exports can be cut off from certain neutrals without danger of giving offense to those nations and thus creating diplomatic tension.

The new board has a staff of 200 to carry on the work of licensing exports, under the direction of Dr. E. E. Pratt, chief of the Bureau of Foreign and Domestic Commerce, who is the representative of the Department of Commerce on the board. This work is already begun. Meanwhile a rush to get exports cleared before licenses are demanded continues. Shippers fear that the "red tape" of getting licenses for each cargo will result in serious delays and are trying to get all shipments off the docks before the licensing bureau can get to work.

The work of the new board, it is said, will greatly relieve England, who has had constant friction with neutrals because of the holding up of consignments of food from America.

Until the United States entered the war, this was a thorn in the side of the Blockade Minister. Despite all watchfulness there have been vast quantities of cereals and other foodstuffs going into Germany from America. Scores of cases are on the dockets of the prize courts involving neutral ships with cargoes from New York, but these seizures represent only a small proportion of the trade actually carried on indirectly with German consumers.

American agents of the Embargo Board to be sent into neutral countries will keep the closest check on reëxports and will be charged with responsibility of seeing that American supplies stop before reaching the German border. To a large extent they will use British machinery built up during the three years that the blockade has been in operation.

Urges Greater Use of Waterways

An effort is being made to promote the use of the interior waterways of the country. The Department of Commerce has issued a circular emphasizing the shortage of rail transportation.

It continues, "Under these circumstances it is necessary that every possible use be made, both for local and through freight, of all interior waterways, canals, rivers and lakes, and this must be done not only as generally but as quickly as possible if we are to escape serious congestion.

"There is more than sufficient business for both railway and waterway for many months to come. Wherever, therefore, throughout the country a barge or a boat, a scow, a lighter or a motor vessel can be made to take the place of a railway car, it ought to be done. Such arrangements as are practical should be made along all our great waterways to develop promptly methods for using the water as a means of transportation. This is the time to get idle barges and scows into use, to repair old barges, to build new ones, and to take advantage of a patriotic duty of water transit in every practicable way.

"Cities and towns on waterways ought in their own interests to take steps to encourage water transit and to extemporize, if need be, means for bringing it quickly into service. Public bodies like chambers of commerce and boards of trade should also take the matter up actively, where conditions make it possible to do so, and give their support to the men who endeavor to develop transportation by water on a temporary or permanent basis. It is encouraging to note the proposed formation of companies to conduct transportation on the Mississippi River. Such organizations today do a patriotic and most helpful service. They should be helped forward, wherever they may be started, in every way."

Repairs to the former German liner "Kronprinzessin Cecile" have been started at an estimated cost of $110,000, and the liner should be ready for sea by the end of next month. Repairs to the "Koln" and "Wittekind" and the Austrian freighter "Erny," are nearly completed.. The "Amerika" and the "Cincinnati" are so extensively damaged they may not be ready before September.

Editorials

Win the War First

THE mining industry is beset by a plague of strikes. We all recall with what disgust we read of the Welsh coal miners going on strike when the product of the mines was badly needed by Great Britain. Now we are confronted by a similar unpatriotic move on the part of the leaders of a certain section of our own metal miners.

Needless to say, the highest officials of organized labor have given assurance of their coöperation in maintaining our productive units at their highest capacity during the war. The strikes in the metal-mining industry are not of their making, but are engineered by the two most violent labor groups in the country, the former Western Federation of Miners and the Industrial Workers of the World. When these two unions came together in Butte three years ago, the Butte district had its first suspension of operations on account of labor troubles. It had always been one of the highest-paid districts in the world, and amicable relations existed between the employers and the miners. That first suspension was not due to differences between the companies and the men, but was an inter-union fight between the I. W. W. and the Western Federation. The latter had lost its radical element to the newer organization, owing to the conservative character of its local, the Butte Miners Union. The struggle with the I. W. W. radical element resulted in the dynamiting of Miners Union Hall and the disruption of the local union. Butte mining companies declined to make any agreement with the I. W. W.'s, and Butte went on the open-shop basis. Since that time there have been no general strikes until this present I. W. W. movement. The trail of violence and murder that has followed the entrance of the Industrial Workers of the World and the Western Federation of Miners (now the International Union of Mine, Mill and Smelter Workers) in practically every district into which they have gone has caused the mine operators everywhere to decline to deal with either of these organizations as representative of their men.

Miners, generally speaking, are getting the highest wages ever paid in the industry—copper miners, especially. These are paid on a sliding scale, this profit-sharing plan being similar to that in the tin-plate industry, the employers and workers in which agreed in a recent conference not to embarrass the Administration with strikes during the progress of the war. Such patriotic sentiments, however, do not animate the I. W W. organization.

Metals are needed to win the war. But from nearly every mining district come reports of strike, strike, strike. If continued, the result will mean stoppage of metal production. How long can the soldiers of our country and those of our Allies afford to be without shells, bullets, bayonets, rifles, artillery, special alloys and the myriad of accessories into which enter the products of the mines?

Only lately has the layman realized that mining is an essential industry for the winning of the war. How long will this crippling-behind-the-line of our soldiers be tolerated? Must we actually sacrifice thousands of soldier lives before we can appreciate the effect of the limited production of his essentials? It is apparent to all that the soldier and the workman-behind-the-soldier must have enough to eat. But can soldiers fight with their stomachs alone? Is the necessity for tools too complex a problem to be fully realized by the mind of the Republic?

The soldier needs food and clothing, but also oil, coal, copper, iron, nickel, lead, zinc, aluminum, tungsten, molybdenum, graphite and a host of other subsidiary minerals and metals to keep the machinery of war going. Shall we supply these continuously or wait until a shortage in some of these essentials has caused our troops to relinquish hard-won ground and then be compelled to sacrifice thousands of lives to regain the territory that might have been held if we had the supplies on hand? Shall we think too late?

The mining industry cannot be restricted without seriously handicapping our chance of military success. What is happening in the copper-mining industry may, and probably will, be extended to the lead, zinc and iron regions. Does the country realize that the Butte district, the most intensive mining district in the world, is practically idle through the activities of the Industrial Workers of the World; that the great smelting and refining works at Anaconda and Great Falls will soon suspend most if not all their production of copper and zinc; that Bisbee, the home of the Phelps-Dodge and other copper interests, heretofore practically free from labor disturbances, has had its production cut in half by the I. W. W.'s effort to take control of these operations through its newly organized Metal Mine Workers Industrial Union? The Clifton-Morenci copper district in eastern Arizona is on strike, and word has come that in the great central districts of Arizona at Globe and Miami the union has called out its members. Across the line in Mexico, Greene-Cananea's American employees have been forced out and the Americans have been compelled to leave other Sonora mines. There are rumors of impending trouble in the Lake Superior iron and copper regions where a few years ago the violence of the I. W. W. caused such a revulsion of public feeling as to result in the enactment of a drastic law forbidding sabotage and the preaching of criminal syndicalism.

In sum, metal output is about to be interfered with in many of the principal mining camps on a pretext of seeking to establish the Metal Mine Workers Industrial Union or some other "child" of the I. W. W. or the International Union of Mine, Mill and Smelter Workers. Whether German money is supplying the sinews of this "war" on metal production, we cannot say, but it is certainly a matter of much concern to our army,

our navy and to "the industries behind the line." Incidentally, it may be pointed out that the Industrial Workers of the World has a large foreign membership, and many of its leaders, if not citizens of enemy countries, are at least so-styled "citizens of the world" with no regard for the welfare of this country or its Government.

Our metal industries are running along over a bridge loaded with dynamite. Some serious and immediate attention is needed unless the industry is to be run by the I. W. W. as is the hope and aim of its leaders. Shall it be industrial conscription? Or shall the idle be conscripted for the front?

If we took this war seriously enough, it would be regarded by everyone as unpatriotic to strike in any of the vital industries. We should lay aside petty, internal differences until the arch enemy of democracy—Pan Germanism—has been put down. Let our Government see that fair treatment is given to soldiers of industry as well as to our soldiers at the front, but our slogan should be "Win the War First."

With the breaking out of these strikes all over the West, especially in the copper-producing districts, it is hard to escape the suspicion that there is some master-hand that is stirring them up—and for a purpose that is not patriotic. Let the Government look into that.

Making New American Citizens

A move in the right direction, and one that might be well followed by all employers of alien labor, has been instituted by the Brown & Sharpe Manufacturing Co., tol and instrument makers, of Providence, R. I., which has taken a census of aliens in its employ and has offered to aid all who have not declared their intentions to do so, to become citizens of the United States.

Our desire to se our friends join our churches, our clubs and our socuieties has not yet extended to an expressed desire to have aliens become citizens. How many of us have ever taken the interest or the trouble to ask or to assist aliens to join us as citizens? Why not follow the example of Brown & Sharpe and get busy in assisting to make citizens of our alien population?

It would be an easy matter to ascertain a workingman's status in regard to citizenship at the time he is employed; a follow-up system for aliens who have not applied for naturalization papers would indicate to him at least that his becoming a citizen is a matter of interest if not of importance to his employer, and the power of suggestion would probably aid materially in bringing in applications for naturalization papers, which otherwise would never be presented.

Think it over!

Respecting Combinations

Washington dispatches in these days often cause us to rub our eyes in amazement and wonder whether we are living in the same country that we lived in a few years ago. "The combination of coal companies in this country today is one of the worst crimes in history. We feel our bearings when we hear such familiar talk. What upse's us is such a statement as that of Edgar E. Clark, member of the Interstate Commerce Commission, that "the coal companies are being allowed to combine with the railroads so that there may be no competition and waste of energy." Arrangements have been made for coal companies, railroads and water transportation lines to pool their interests in some cases. Already there has been a marked decrease in the cost of producing and distributing coal, and the Interstate Commerce Commission authorities declare that the railroads would save $600,000,000 annually under the new combination permitted by the Government. Instead of working in competition with more than a hundred different gradings, the coal companies have reduced their gradings to less than a dozen. On Lake Superior the coal companies now have common distribution points instead of individual bunkers for each company. Similar arrangements are being made at Newport News, Baltimore and Philadelphia.

Is it possible that the people of the United States are going to awake to the realization that the great corporations through their efficiency have reduced the cost of living, that although their promoters have realized great wealth from their ideas, they have nevertheless been benefactors of the people, that the real malefactors are the little fellows who make the people pay for their carelessness and wastefulness?

The French Coal Mines

The coal production of France is said now to amount to about 2,300,000 tons per month against 1,900,000 tons last December, the increase being due to the use of 7000 miners released fro mmilitary service. Manifestly such men can do more for their country in its mines than in its army.

Albert Claveille, Under Secretary of Transportation in the French ministry, was quoted not long ago as saying:

"If America could send us a coal mining contingent in addition to the engineering corps for railroad and canal work, it would be a great boon to us. It should be headed by men capable of directing necessary repairs to mines and of organizing intensified production, and should comprise coal miners, who are lacking here now. The great advantage in this would be to release for transportation and other necessities ships now bringing coal to France."

Will the Vicious Circle Be Broken

The labor leaders have more sense than those members of Congress who have been opposing the food bill. According to press dispatches they are more concerned with the reduction of food prices than they are with increases in wages. They regard food prices for the most part as abnormal and unjustified and do not believe the problem ought to be dodged by the expedient of raising the workingmen's wages in order to allow them to meet the increased cost of living. They think the root of the trouble can b ereached only by eliminating fod gambling, hoarding and wide margins of profit. Nothing could be more encouraging than this recognition of the vicious circle. This is another of the blessings that we owe to Hoover.

BY THE WAY

Our idea of zero in "inside information is the following from a Western broker's letter to customers: "Information we have from reliable sources is to the effect that gold will increase from its present price of $20 an ounce to $30 an ounce." Then comes the usual offering of the discovery of an exceptional mine, and then this clinches: "Canadian and British syndicates are searching this country for gold properties because gold is staple and the ratio of its buying power is sure to increase to meet the present unusual world conditions. The credit of the European countries is overdrawn, and they must have gold reserves."

All joy went out of the lives of 37 disheveled, unshaven "vags" at police headquarters in Salt Lake City, on June 17, when Chief J. Parley White answered their plea of inability to secure employment by producing Alexander Christensen, industrial agent of the American Smelting and Refining Co., who declared he could use the whole 37 and 200 others at once for construction work at the Garfield smeltery. The idlers reluctantly submitted to their inevitable fate, and a few hours later were on their way to Garfield, where they are condemned to toil until further notice for a daily remuneration of $2.50. Since the edict went forth from Chief White last month that every able-bodied man in Salt Lake must be a producer, the city's chain gang has swelled to proportions that exceeded the capacity of the city jail and Chief White was in a dilemma. In casting about for some other outlet for captive energy, he accidentally learned of the demand for labor at the Garfield smeltery and communicated with Mr. Christensen. Before the police court opened yesterday Chief White gave the 37 loafers the alternative of going to work or serving jail terms. The professional idlers will soon be shunning Salt Lake's "inhospitable" shores.

Every accident teaches a lesson, or should teach one; also, it occasionally happens that an accident very efficiently teaches a much-needed lesson and at the same time comes within the "Purely accidental" classification of the state mine inspector. The case of Bernardo Ortiz belongs to the latter kind. Bernardo is a machine man in the mines of the Phelps Dodge Corporation, at Morenci, Ariz. Up until ten days ago, he believed in the time-honored method of pounding on the machine with a double-jack, piece of steel or any other handy weapon in case the machine refused to respond to his expert touch. But Bernardo is not now of that faith. Something happened that suddenly changed his mind. The occurrence was this: He was drilling in a raise with a B. C. 21 Ingersoll-Rand stoper. Essaying to change to a longer drill, he found that the steel was stuck in the chuck. As per custom, he seized the 6-lb. hammer lying by and plied same with vim. For was he not working on a contract? He brought the hammer down on the fronthead, which stood just a little above the man's waist. At the last stroke he gave the machine, however, a piece of steel about the size of a .22 caliber bullet flaked off the edge of the fronthead and entered the man's abdomen, perforating his large intestine and an artery. The doctor found the bullet in the neighborhood of the man's kidneys, and the patient is getting well. The state mine inspector is satisfied the accident was not the company's fault, and the operators are satisfied the Spaniard will not hammer the machine again.

June Mining Dividends

Dividends paid in June, 1917, by 49 United States mining and metallurgical companies making public returns amounted to $38,365,938, as compared with $35,590,478 paid by 53 companies in June, 1916. Holding companies allied to mining paid $768,433, as compared with $1,588,492 in 1916. Canadian, South American and Mexican companies paid $1,892,601 in June, 1917, and $1,931,333 in June, 1916.

The totals for the first six months of the year 1917 are as follows: Mining and metallurgical companies, $104,595,139; holding companies, $3,547,789; Canadian, Central American, South American and Mexican mines, $10,174,859. The table shows the month's payments.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Sm. and Ref., com	U. S.-Mex.	$1.50	$914,970
Am. Sm. and Ref., pfd	U. S.-Mex.	1.75	875,000
Argonaut Cons., g	Calif.	.10	20,000
Bunker Hill & Sullivan, l. s	Ida.	.50	163,500
Butte & Superior, z	Mont.	2.50	725,492
Caledonia, l. s	Ida.	.03	78,150
Calumet & Ariz., c	Ariz.	3.00	1,927,386
Calumet & Hecla, c	Mich.	25.00	2,500,000
Champion, c	Mich.	6.40	640,000
Chino, c	N. M.	2.50	2,174,950
Cons. Interstate-Callahan, l. s. z	Ida.	1.00	464,990
Copper Range, c	Mich.	2.50	987,500
Cresson, g. s	Colo.	.10	122,000
Eagle & Blue Bell, s. l	Utah	.10	89,315
Eastern Talc	Vt.	.15	10,454
Electric Point, l	Wash.	.03	23,812
Federal Min. & Sm., pfd	U. S.	1.75	209,757
Golden Cycle, g	Colo.	.03	45,000
Grand Central	Utah	.04	20,000
Grand Gulch	Ariz.	.04	9,594
Hecla, l. s	Ida.	15	150,000
Hercules, l. s	Ida.	.30	*300,000
Homestake, g	S. D.	.65	163,254
Internat. Nickel	U. S.-Can.	1.50	2,510,076
Kennecott, c	.....	1.50	4,170,874
Magma, c	Ariz.	.50	120,000
Mammoth, g. s. l. c	Utah	.25	100,000
Nevada Con., c	Nev.	1.00	1,999,457
New Idria, q	Calif.	1.00	100,000
New Jersey Zinc	U. S.	4.00	1,400,000
Old Dominion, c	Ariz.	3.00	891,213
Oroville Dredging, g	Calif.	.12	82,385
Phelps, Dodge	U. S.-Mex.	8.00	3,600,000
Prince Cons., g. s	Utah	.02½	25,000
Quincy, c	Mich.	5.00	550,000
Ray Con., c	Ariz.	1.00	1,577,179
Rescue-Eula, g. s	Nev.	.02½	35,700
Richmond, l. s	Ida.	.02	16,000
St. Joseph Lead	Mo.	.75	1,057,098
Silver King Con., s. l	Utah	.15	103,287
Star Cons. Mines, s. l. z	Colo.	.20	.....
Tintic Standard	Utah	.02	23,000
Tomboy, g	Colo.	.24	75,330
United Copper	Wash.	.01	10,000
United Verde, c	Ariz.	1.50	450,000
Utah Con., c	Utah	1.00	300,000
Utah Copper	Utah	3.50	5,685,715
Uvada Copper	Nev.	.01	6,000
Yak, s. l	Colo.	.57	570,000
Yellow Pine, z. l	Nev.	.06	30,000
Yukon Gold, g	Alaska	.07½	262,500

Canadian, Mexican and South American Companies	Situation	Per Share	Total
Cerro de Pasco, c	So. Am.	1.50	999,999
Dome Mines, s	Ont.	.25	100,000
Hedley, g	B. C.	.50	60,000
Kerr Lake, s	Ont.	.25	150,000
Lucky Tiger-Com., s	Mex.	.09	64,380
Mexico Mines of El Oro, g	Mex.	.96	174,960
Min. Corpn. of Can., s	Ont.	.18¾	311,260
Utica Mines l.s.z	B. C.	.02	32,002
Holding Companies	**Situation**	**Per Share**	**Total**
General Dev	U. S.	2.00	240,000
St. Mary's Min. Land, c	Mich.	2.00	320,000
Yukon-Alaska Trust	.....	1.00	208,433

* Estimated

Initial dividends were paid in June by Rescue Eula, Richmond Mining, Milling and Reduction, Tintic Standard Mining, and Utica Mines, Ltd.

Personals

H. Alfred Millard announces the removal of his New York offices from 60 Wall St. to 2 Rector Street.

C. T. Griswold, geologist of the Associated Geological Engineers of New York, has gone to Wyoming.

Dr. John H. Banks has returned to New York from Arizona where he has been examining in the Jerome district.

Herbert C. Enos has returned to Denver from New Mexico, where he has been making examinations for Silverton interests.

Rudolph Agassiz, president of the Calumet & Hecla Mining Co., is making his regular summer trip of inspection to the mine.

A. G. Pérez has resigned from the position of administrator of the Boletín Minero and the Boletin del Petroleo, both published in Mexico.

Kirby Thomas has returned to New York from Ontario, where he examined silver and copper-silver properties in the Cobalt and White Bear Lake districts.

S. C. Dickinson, formerly with the United States Bureau of Mines, assumed the duties of safety engineer with Arizona State Bureau of Mines on July 1.

Samuel Mather, of Pickands, Mather & Co., Cleveland, gave $100,000 in railroad securities to Kenyon college on the occasion of its 89th commencement.

Charles Oliver, in charge of sales of the Oliver Iron and Steel Co., Pittsburgh, has enrolled with the Officers' Reserve Corps, stationed at Fort Niagara, N. Y.

H. M. Ridge, at a meeting of the Society of Chemical Industry, recently held in London, read a paper on "The Utilization of the Sulphur Contents of Zinc Ore."

Col. J. W. Boyle, a well known Yukon mining engineer and transportation expert, now overseas, has been sent to Russia to aid in the reorganization of the railroad system.

Samuel Lindsey Nicholson, formerly sales manager of the Westinghouse Electric and Manufacturing Co., has been promoted to be assistant to the vice president of that company.

Howland Bancroft, having finished examinations in Colorado, Wyoming and New Mexico has gone to New York, where he will be at the Engineers Club until the middle of July.

H. H. S. Handy, vice president of the Semet-Solvay Co., Solvay, N. Y., has been appointed a member of the committee on coal tar by-products of the Council of National Defense.

J. Volney Lewis, professor of geology in Rutgers College, will spend about three months this season in the examination of gold and copper mines in Alaska and northern British Columbia.

Prof. A. Ledoux, of Toronto University, is investigating for the Ontario Department of Mines the sand and gravel deposits in the neighborhood of Brockville, Ont., with a view to their economic utilization.

H. M. Roche, superintendent for the past five years of the Mt. Hope mines of the Empire Steel & Iron Co., has resigned and accepted the position of General Superintendent of Mines for the Wharton Steel Co.

H. D. Shute, recently elected vice president of the Westinghouse Electric and Manufacturing Co., will have executive charge of the company's commercial organization, succeeding vice president L. A. Osborne.

Arthur F. Braid has assumed the duties of metallurgical engineer in charge of metal sales for the Goldschmidt Thermit Co. of Jersey City, N. J. He succeeds DeC. Brown, who has joined the Officers' Reserve Corps at Plattsburg.

E. E. Thum has resigned as Assistant Professor of Metallurgy, University of Cincinnati, to become Associate Editor of "Metallurgical and Chemical Engineering." Previous to his teaching engagement, he was for many years engineer in charge of construction at various smelting plants of the Anaconda Copper Mining Co.

J. B. Tyrrell, of Toronto, has been appointed Canadian representative of the Consolidated Mines Selection Co., one of the strongest British mining companies, which has operated extensively in South Africa and now contemplates entering the northern Ontario field. Walter McDermott, the president of the company, began his mining career in Canada in connection with the old Silver Islet mine on the north shore of Lake Superior in 1872.

Obituary

William C. Shackelford died at Birmingham, Ala., June 24, age 58 years. He was born in Alabama and had lived in Birmingham 27 years, being interested in several coal and iron properties. He was president of the Eclipse Coal Co., the Calcis Lime Co., and the Southern Iron Corporation. He took a prominent part in the establishment of water connection between the Birmingham district and Mobile by the Black Warrior River and other improvements.

Colonel Oliver Hazard Payne died in New York, June 27, aged 78 years. He was born in Cleveland, O., and graduated from Yale in 1802. He inherited a fortune from his father and was largely interested in iron and oil enterprises, being prominent in the Cleveland group of the Standard Oil Co. owners. Later he acquired a large interest in the Tennessee Coal, Iron and Railroad Co., and was mainly intrumental in the sale of that company to the United States Steel Corporation. He made some large gifts to Cornell University and other colleges. He was a director in the Standard Oil Co., the American Tobacco Co., Virginia & Southeastern Railway Co., Coal Creek Mining and Manufacturing Co., and many other corporations.

Societies

Wisconsin Mining School—The Wisconsin State Legislature has recently passed appropriations for the Mining School at Platteville amounting to $43,275. The additional funds thus provided will be used mostly for the purchase of new equipment. The course will be enlarged and extended to cover three years. Among the new branches added are Spanish, commercial law, mine accounting, rhetoric and public speaking. The next school year begins Sept. 3.

Exposition of Chemical Industries. The third exposition will be held at Grand Central Palace, New York, during the week of Sept. 24, 1917. Preparations for the event are now in active progress. The arrangements are in the hands of an advisory committee composed of Charles H. Herty, chairman, Raymond F. Bacon, L. H. Baekeland, Henry B. Faber, Colin G. Fink, Bernhard C. Hesse, A. D. Little, R. P. Perry, Wm. Cooper Procter, E. F. Roeber, G. W. Thompson, T. B. Wagner, Utley Wedge and M. C. Whitaker. The managers Charles F. Roth and F. W. Payne, report that the exposition will be larger this year and more interesting than its predecessors. At the close of the past exposition much of the space available on two floors was re-engaged by exhibitors for this coming exposition, for which the floors are now completely taken and the greater part of the available space on the third floor engaged.

American Committee of Engineers in London has been formed of American engineers and practical business men in London for the purpose of suggesting to the government of the United States plans which may be useful in carrying on the war and to offer their services for consultation and advice to representatives of the American government should this be desired. Among those instrumental in forming this committee are Col. J. W. Boyle, W. B. Poland, Col. Millard Hunsicker, R. Gilman Brown, D. P. Mitchell, Millard Shaler, Norman C. Stines and other well known men. The only officer for the present is to be an Honorary Secretary. C. W. Purington has been appointed to this office. Sub-committees will be appointed to consider proposals and other recommendations, which may be suggested. Among the plans which are now being studied, are the following: A plan of assistance to be offered by the United States to the Russian government for improving the conditions of railway transport; A recommendation covering the development of a grain producing area in the Amur district in Siberia, tributary to the Pacific, with the object of making the grain so produced available for return cargoes from Siberian ports for such tonnage as now returns in ballast; A project to build wooden ships in heavily timbered zones along the Siberian seaboard, the Amur river and the adjacent coast.

Colorado School of Mines is still the scene of grave troubles. The dismissal of Howard C. Parmelee as president was the disgraceful culmination of the past year's series of internal disturbances that were cumulative in effect. The administration of Mr. Parmelee was strictly according to his highest conceptions of principle in the enforcement of discipline as directed by the established rules of the college. But he was made to suffer because the student body secured the backing of the financial and trades people of Golden. These townspeople, through the leading banker—one of the school's trustees—pressed their demand for another change in the presidency. Though shortsighted in the extreme, this action was carried out with the notion that a new man could be readily found to fill this responsible and difficult position. In fact, the three trustees who voted against Parmelee did so, fully believing that Milo S. Ketchum, dean of the college of engineering in the University of Colorado, would promptly accept the offer at $8000 per year, a salary never before considered here. However, it required very little time for Mr. Ketchum to reach a decision and to notify the trustees of his declination. Mr. Rubey and Mr. Carlton, the trustees appointed as a committee to select a president, now have an interesting summer's task. In view of the failure of the board to support the president and faculty consistently in times when matters of student discipline and scholarship have arisen, it is doubtful if any experienced educator who would prove acceptable to all concerned can be induced to accept the presidency. Public sentiment is strong in its sympathy with Mr. Parmelee and decidedly denunciatory of the trustees' actions. At present there is no faculty whatever. The school is wholly demoralized. No appointments for next year have been made, the trustees having voted to leave the selection of next year's corps of instructors entirely with the incoming president. In consequence, the professors are totally ignorant regarding their future and several of them are seeking engagements elsewhere. The prospect is altogether dismal.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Acetylene-Lamp. Augie L. Hansen, Chicago, Ill., assignor to Justrite Manufacturing Company, Chicago, Ill. (U. S. No. 1,230,892; June 26. 1917.)

Amalgamating Process for Recovering Metals from Ores. Paul Kuehn, Detroit, Mich. (U. S. No. 1,231,176; June 26, 1917.)

Amalgamation—Separator and Amalgamator. Adolph P. Palmer, Oakland, Calif. (U. S. No. 1,231,420; June 26, 1917.)

Classifying — Improved Washing and Classifying Apparatus for Ores. Gustave Pinette, Saone-et-Loire, France. (Brit. No. 105,690.)

Concentration—Improvements in or Relating to the Concentration of Ores. Henry Livingstone Sulman, London, E. C., Edwin Edser, Brockley, London, S. E. and Minerals Separation, Ltd., London, E. C., England. (Brit. No. 105,627.)

Crucible Furnaces—Improvements in and Connected with Crucible Furnaces. Frederick Samuel Wiglev, Birmingham, England. (Brit. No. 105,146.)

Drilling — Improvements in Percussion Rock Drills and Coal Cutters Operated by Fluid Pressure. James Fletcher, New South Wales, Australia. (Brit. No. 105,528.)

Ferrosilicon—Process of Producing Ferrosilicon of High Silicon Content in Blast-Furnaces. Joseph E. Johnson, Jr., Hartsdale, N. Y. (U. S. No. 1,231,260; June 26, 1917.)

Gold-Concentrating Plant. Nathan L. Raber, Corvallis, Ore. (U. S. No. 1,231,297; June 26, 1917.)

Magnesium—Process of Making Magnesium Compounds from Silicate Minerals. Samuel Peacock, Philadelphia, Penn., assignor, by mesne assignments, to Marden, Orth & Hastings Co., Inc., New York, N. Y. (U. S. No. 1,231,423; June 26, 1917.)

Manganese Alloys—Making Low-Carbon Manganese Alloys. Ernest Humbert, Niagara Falls, N. Y. (U. S. No. 1,228,925; June 5, 1917.)

Metal Alloy. Hugh S. Cooper, Cleveland, Ohio, assignor to The Electro Metals Products Company, Cleveland, Ohio. (U. S. No. 1,229,985; June 5, 1917.)

Mine-Door. Alonzo Blevins, Charles F. Kilgore, and Allen L. Blevins, Coeburn, Va., assignors, by direct and mesne assignments, of one-fourth to said Alonzo Blevins and one-fourth to said Kilgore, and one-fourth to Mason L. Johnson and one-fourth to Joseph J. Body, Dante, Va. (U. S. No. 1,228,643; June 5. 1917.)

Editorial Correspondence

SAN FRANCISCO—June 28

Tightner Mine, in Sierra County, is paid for. The final payment, making a total of $550,000, was made in the first week of June. And besides paying for the mine the present owners have paid dividends of $100 to $1000 per share. Just how much the total dividends amount to is not made public. But it is probably a safe estimate that the mine has produced close to $1,000,000 in the five years since H. L. Johnson, the former owner, turned it over to a group of men, chiefly of the North Star mines, in Grass Valley, who optioned the property in the belief that practical modern mining methods would develop a great mine where pocket hunting and "jewelry" mining had merely made sensational and spectacular disclosures of free gold in quartz. The same methods that have obtained at the North Star and other great mines in the Grass Valley and Nevada City districts in Nevada County were applied to the operation of the Tightner, with the result that a mine has been developed and paid for, and surplus money earned during the period of development.

Mining Legislation in California directly affecting the mining industry enacted by the 1917 session of the legislature, with the exception of the more liberal compensation act, had the approval of the California Metal Producers' Association. This is due in a great measure to the activity displayed by the committee and other members of the association in protesting the passage of some of the measures proposed. The following is a brief resume of the bills offered and the result of legislative action: H. B. 74 and 211, providing for amendments to the semi-monthly pay-day bill: No. 74 failed of passage and No. 211, as amended, passed but failed to receive the approval of the governor. H. B. 172, and others providing for Sunday closing, defeated after the adoption of numerous amendments. H. B. 250, by Williams, providing for the payment of wages in cash, was not acted upon by the committee to which it was referred. H. B. 534, by Williams, making it a misdemeanor for employers to discharge an employee for refusal to patronize a boarding-house or hotel conducted by such employer, was passed but vetoed by the governor on Apr. 20, 1917. H. B. 594 and 994, by Harris, providing for amendments to the eight-hour law and restrictions governing hospital protection or insurance were reported from committee without recommendation and no further action taken. H. B. 1324, by Goetting, in reference to publicity of ownership of stock, etc., failed of consideration by the committee on corporations. S. B. 437, by Lyon, providing for the payment of wages by draft drawn upon some bank or established place of business within the county where the work is performed was passed after amendment but vetoed by the governor on June 1, 1917. S. B. 1017, by Lyon, providing for the issuance of a certificate or contract of employment was denied consideration by the committee on labor and capital. S. B. 1035, by Flaherty, known as the anti-injunction law was passed but vetoed by the governor on June 1, 1917. S. B. 816 and 823, providing for an amendment to the act relating to the storage and transportation of powder and the repeal of the mine bell-signal law, were passed and approved by the governor. Senate bills by Luce practically re-enacting the Workmen's Compensation, Insurance and Safety Act to be made effective Jan. 1, 1918, were passed after the adoption of a great many amendments and have received the approval of the governor. Senate constitutional amendment No. 30, by Luce, providing for social or health insurance was adopted. H. B. 1441, by Brackett, known as the eight-hour "collar-to-collar" bill was tabled by the committee on mines and mining by a vote of 8 to 1, and received no further consideration.

BUTTE—June 28

Butte Mines Working Day Shift with about one-quarter of the normal crew. No attempt has yet been made to work in the mines at night. The action of the local unions of the electricians, machinists and blacksmiths going on strike without the approval of the national officers has complicated the situation. Some of the machinists and blacksmiths went on strike while others remained at work. On Wednesday night, June 27, the engineers held a largely attended meeting and decided by a vote of 352 to 295 to endorse the demands of the electrical workers as far as they applied to an increase of wages for themselves but declined to endorse the demands of the electrical workers as far as the backing of the Metal Mine Workers Industrial Union was concerned. The Butte mill and smeltermen held a meeting also and turned in their charter that connects them with the American Federation of Labor. The committees from the Metal Trades, the Building Trades and the Silver Bow Trades and Labor Council also held conferences, endorsed the electrical workers' demands for more wages but did not endorse the miners. Representatives of the international unions represented in Butte have arrived here and also W. H. Rodgers, representing the U. S. Bureau of Labor. Conference after conference has been held in an effort to straighten out the tangle. The representatives of the mining companies have declared that under no circumstances will they have any dealings with the Metal Mine Workers Industrial Union. The leaders of this organization are the same men who helped three years ago to destroy the old Butte Miners' Union and organized the new I. W. W. union. Evidence has been secured to show that they are being helped in their organization by W. D. Haywood and organizers of the I. W. W. The leaders who were recently active in the efforts to defeat conscription in Butte, consisting of radical Irish and Finlanders, are running the new union. For these reasons the mining companies look upon these men as foes of the mining industry in Butte, as well as enemies of the United States. It is possible that the mining companies and the regular unions connected with the American Federation of Labor will be able to get together and that both sides will make some concessions that will result in patching up the matter. This would bring back all the electricians, machinists and blacksmiths and engineers and put the companies into a position where the mines can be operated steadily. If this be done, the companies have no fear about securing plenty of miners and within a week or two the conditions would probably be normal once more. Mr. Rodgers representing the Federal Government is holding conferences with all the parties interested and is reported to be encouraged over the prospect of a settlement. The Government is directly interested for the mines of Butte produce about one-seventh of all the copper produced in the United States and nearly one-half of the zinc produced and these metals are absolutely necessary in the manufacture of munitions of war.

DENVER—June 29

Smelter Investigating Committee has appointed O. R. Whitaker, of Denver, technical advisor. Mr. Whitaker is a mining engineer of wide experience, and under his direction the investigation of smelting charges, for which purpose the committee was appointed by the last general assembly, will be carried to a conclusion. Much information has already been gathered by the board in the form of affidavits by mine operators. Later, hearings will be held at which smelting-company officials will be asked to appear.

Strike Threatened at Leadville by the International Union of Mine, Mill and Smelter Workers. Dissatisfaction is over the refusal of the mine owners to make a flat raise of $1 per day in wages. Mines have made an increase of 50c. per day already this year and it is contended that profits do not warrant a further increase. An investigation by the state industrial relations commission, asked for by the miners' union, confirmed the decision of the mine owners. If the union workmen strike, it is probable that the nonunion men, who outnumber them two to one in the camp, will also walk out, simply to avoid the usual disturbances. The situation is complicated by the fact that Leadville contains many Austrian subjects hostile to our Government. Many of these refused to register on June 5, and 42 were imprisoned. Sheriff Henry Shraeder, of Lake County, states he expects to arrest about 50 more. On account of threats made to blow up the transformer station of the Colorado Power Co. and mine buildings, a detail of the First Colorado Cavalry has been hurried to the district from the Golden encampment, and is now under command of Lieutenant Hawksworth. The cutting off of electric power would be serious as many of the mines would then be flooded and an immense monetary loss, as well as curtailment of metal production this year, would result. Authorities believe that even in case of strike, which now seems almost unavoidable, the situation can be handled without serious disturbances.

Bull Domingo was a well-known Colorado lead-silver mine 30 years ago. It is at Westcliffe, in Custer County. Production continued until the combined effects of heavy zinc penalty in smelting and the demonetization of silver rendered further operations unprofitable. In mining, it was impossible to prevent the mixing of considerable amounts of sphalerite with the desirable silver-bearing galena. Louis Wagner, of Denver, who was instrumental, some years ago, in reviving the Mary Murphy mine at St. Elmo, has undertaken the resumption of mining in the Bull Domingo, where he believes large bodies of ore will average 25% zinc. He states that former operators did not exploit more than a fraction of the mineralized ground so that there remain potentialities for a further production of good silver ore as well as much zinc ore. The large mine dumps are said to constitute good feed for a concentration mill.

OATMAN, ARIZ.—June 28

Diamond-Drill Exploration will be tested out thoroughly in the Oatman district for the first time on two properties. Manager McIver, of the Telluride, is preparing to prospect that company's ground from the surface by diamond drills. The Telluride adjoins the Tom Reed and two shafts have been sunk, one 250 ft. deep and one 635 ft. deep, both opening up the Telluride vein, which is regarded as an extension of the Tom Reed-United Eastern vein system. At the Mohawk Central, diamond drills will be used to crosscut from the 400-ft. station to all parts of the claim. M. J. Monette, formerly of the Hayes-Monette lease in Goldfield, is president of the Mohawk Central.

CLIFTON, ARIZ.—July 2
(By Telegraph)

Strike Closed Mines of the Clifton-Morenci district on July 1. Miners, millmen and smeltermen went on strike for the Miami scale of wages. Properties of the Detroit, Arizona Copper and Shannon Copper Co., ceased operating at 10 o'clock on Sunday morning. The companies have the properties well guarded with loyal men. Sheriff Slaughter has added extra deputies to his force and has control of the situation.

HOUGHTON, MICH.—June 26

Utilizing Waste Sands from old mines in the Lake country is attracting further attention. Some day the abandoned and waste sands at many of the old mine locations of Keweenaw County are going to yield profits either to the owners or to persons who may lease them for the purpose of working out the copper lost therein. Some of these sands, particularly at the old Cliff mine, now controlled by the Calumet & Hecla and allied interests, and others, are said to be richer in copper than the Calumet & Hecla sands, which are now yielding millions of pounds of copper each year, at a low cost of recovery. The old mine sands were deposited from 20 to 50 years ago, in the days when milling machinery was by no means what it now is, consequently a great deal of copper that would now be recoverable from the rock was discarded with the waste sands. There is one old mining man, and his son, working now on the sands and old rock burrows at the Cliff mine, picking over the rock by hand. They are taking out considerable copper, working the material in a crudely arranged mill, which contains a "rough," two Wilfleys and other equipment, most of which is rather out-of-date, but enables them to make something more than a living. It is probable that the sands at at least one of the old mining locations of Keweenaw that gained fame for its copper output in the 50's and 60's will be leased by interests now forming and that the sands

will be thoroughly tested for their copper content. Calumet & Hecla has proved conclusively that its sands can be reworked; after being dredged from Torch Lake, they are reground and run through the leaching plant, producing copper at a cost of not more than 6c. per lb. and eventually costs will likely go even lower. The Tamarack, Quincy, Franklin and other sand heaps contain great amounts of recoverable copper that will be worked some day. Many of these sands have already been tested.

TORONTO—June 30

Labor Conditions in Northern Ontario are still unsettled and the outcome doubtful. Due to the action of several of the mines in Porcupine in increasing the wages by 50c. a day, the situation there is much better and there is now little chance of trouble. At a vote taken last Sunday in Cobalt, however, 1100 out of 1200 men voted in favor of a strike and the matter is now in the hands of the union executive. As the men are now receiving as much money as the union scale calls for, the operators consider that the attempt to force wages to be paid as a flat rate instead of bonuses, is simply for the purpose of trying to gain recognition of the union. This body they refuse to recognize and it is stated that a number of the mines will close in the event of a strike being called. However, it is impossible to forecast what will take place because, unfortunately, the operators do not work together so well as the men. Some of the operators, it is rumored, have already decided to grant the flat rate.

JOPLIN, MO.—June 30

Railroad to Picher, Okla., will be part of the Fourth of July celebration at this richest camp of the Joplin district. On that day the first passenger train will enter the town over the tracks of the Mineral Belt Railroad, which connects with the Frisco at Quapaw, Okla. The road was laid from Quapaw to Century, some time ago, then on to Tar River, or Cardin, as it is still called by some, and then on to Picher, making a semi-loop. It is expected that eventually the line will be built on to Baxter Springs, Kan., or to Columbus, Kan. While it is supposedly an independent line, it is on friendly relations with the Frisco and it is even reported that the freight for it was "dead-headed." Meantime, the building of the Southwest Missouri R.R. Co.'s interurban extension from Galena to Baxter is progressing rapidly, and A. H. Rogers, president of the road, has announced that he hopes to have cars running to Picher by Oct. 1. Picher now claims over 4000 people. It has no sewer system and can have none because most of the land on which it is located is owned by Indians and sewer bonds cannot be voted. Sanitary conditions are fairly good and there has been no epidemic of sickness as yet, and the new town's authorities are doing their best to prevent any. Water has been obtained from one deep well, and another has just been put down. Water sells about the town at as high as 35 cents a barrel.

WASHINGTON—July 2

No Material Decline in Spelter may be expected, according to C. E. Siebenthal, the zinc specialist of the U. S. Geological Survey. Should there be a decline in the price of spelter, Mr. Siebenthal argues, "it probably would so reduce the output of sphalerite concentrates from the sheet ground of the Joplin region as to react upon the price of spelter, causing it to rise again." Commenting further on the zinc situation, Mr. Siebenthal says: "The zinc reserves of the country have shown themselves to be equal to all demands made upon them. In fact, the production of zinc ore has been so large that further decline in ore prices with resultant demoralization of the domestic zinc-mining industry can be prevented only by a material increase in the demands for spelter or by a lessened supply of foreign ore. An increase in the demand for spelter seems probable and imports of zinc ore may decrease also, if shipments from Spain and Australia are interfered with by submarines, or if shipments of zinc ore from Mexico are prevented. The zinc content of zinc ore imported in 1915 amounted to 57,669 short tons and in 1916 to 148,147 tons. Mexico and Australia each furnished about one-third of the imports. The imports of zinc ore for the first four months of 1917 indicated a falling off of 40% from the average monthly imports in 1916."

HAVANA, CUBA—June 30

Oil Drilling in Cuba has been stimulated by the commercial production obtained at the Union Oil Co.'s No. 5 well, about 13 miles from Havana. The Pearson interests, which were drilling here several years ago sold their outfit to the Antillian Corporation about a year ago, and the latter is drilling a well on the Georgina claim near the town of Guines in Havana Province. The well is down over 3000 ft., and it is reported that work has been stopped for the present. The company is drilling a well on another claim the Antillana, near the village of Managua on the road from Havana to Batabano, on the backbone of the Island. Some encouraging gas and oil showings have been encountered. The geology both of the Georgina and Antillana claims apparently differs from that of the Bacuranao district where the Union Oil Co. and the Cuban Petroleum Co. are drilling. The formation is composed of limestone, and probably sandstone, strata forming a large anticline which runs nearly east and west through the center of the Island. On June 20 a bill was passed by the Cuban Senate declaring fuel oil practically free of duty on entering Cuban ports. The bill is now in the House for discussion and the chances are that it will pass. Of course, this measure does not interfere with the oil-producing industry of the country, as the oil produced in Cuba is not a fuel oil, but a high-grade distilling oil. Asphalt mines at Mariel in the Province of Pinar del Rio have been leased by a company recently formed which is experimenting with the product in order to make it fit for road work. It is reported that an order for a few hundred thousand tons has been placed with the people working the Mariel mines by the South African government for road-metal binder.

The Mining News

ARKANSAS

Batesville County

BATESVILLE MANGANESE FIELD is producing 1000 tons monthly. Walter Dennison, largest producer and ore buyer. Most of the ore is going to Alabama furnaces. Mined from openpits and shallow shafts.

Baxter County

ANNA MAY (Buffalo)—Temple Mining Co., of Pittsburg, Kan., has leased this zinc mine; ore blende and carbonate. C. A. Ludlow in charge.

Marion County

HELVA (Rush)—H. Sour has started 150-ton mill.

BELLE (Rush)—This zinc mine owned by James McCarty, of Yellville, is receiving machinery for 100-ton mill.

UNION DEVELOPMENT CO. (Buffalo)—A. Christianson, of Chicago and associates leased 400 acres of zinc land.

WILLETT (Yellville)—Carbonate-of-zinc mine, owned by W. R. Willett, leased to C. D. Murphy and associates, Oklahoma City, Okla. Will build 100-ton mill at once.

Searcy County

TOMAHAWK (St. Joe)—Being operated by Tomahawk Copper Co.; building 10-ton furnace. Only active copper mine in state. C. H. Burke, manager.

ARIZONA

Cochise County

STRIKE of miners started on July 1 by members of the Metal Mine Workers Industrial Union. From 40 to 50% of men quit the Copper Queen and Calumet & Arizona mines on the first day; the Shattuck Arizona is not working any men in the mine but mechanics and surface crews are working.

PEERLESS (Dragon)—Charles Starek and C. L. Graves developing contact copper deposit in this property adjoining the Centurion. In sulphides at 350 ft. C. L. Graves in charge.

Gila County

STRIKE called July 1 in Miami district by the Metal Mine Workers Industrial Union, the I. W. W. local. Mines and reduction plants of the Miami, Inspiration and International companies completely tied up. In Globe, only about 75 miners obeyed the strike call at 3 p.m., but tie-up was expected to be practically complete on July 2.

GLOBE-DOMINION (Globe)—Shaft on this property, about two miles from Globe, is down 360 ft.; progress 5 ft. per day. Objective is 1000 ft. but crosscut will be started at 600 ft. James H. Barr, of National Supply Co., president; B. O. Thralls, superintendent.

Greenlee County

ASH PEAK EXTENSION (Duncan)—Sinking shaft; now down about 125 ft. George Powell, manager.

ARIZONA MAYFLOWER (Duncan)—Preparing to resume at both the Water and Wampoo shafts. Low-grade copper orebodies sought. W. B. Duvall, manager.

ASH PEAK MINES (Duncan)—Now being operated by the Goldfield Consolidated company which has arranged to sink Commerce shaft from 200- to 500-ft. level. Additional machinery being installed. The Commerce shaft is about 2200 ft. from the main shaft, the Shamrock, sunk by present operators from 500- to 600-ft. level. Considerable milling ore; silver, in quartz. William H. Kinnon in charge.

Mohave County

UNITED EASTERN (Oatman)—Sinking of the main shaft 300 ft. has been started; concrete bulkhead will be installed near bottom of present shaft and a supplementary hoist used for sinking; crosscuts are to be run at 815 ft. and at 965 ft. Three new Dorr agitators are to be added to increase mill capacity to 300 tons; crushing capacity 400 tons daily. J. A. Burgess, superintendent.

Pinal County

RAY CONSOLIDATED (Ray)—May production of copper was 8,015,281 lb., comparing with 7,902,724 in April and 6,278,611 lb. in May, last year.

Yavapai County

CONSOLIDATED ARIZONA SMELTING (Humboldt)—Directors have declared two quarterly dividends of 5c. each, payable Aug. 15 and Nov. 15—the first disbursements of this or its precedent company. The smelting plant was built 12 years ago, by the Arizona Smelting Co.

CALIFORNIA

Amador County

KENNEDY (Jackson)—Orebody recently disclosed in the 3900 level has been developed for width of 52 ft. While it is of milling grade, the exact assay has not been stated.

Calaveras County

PENN MINING (Campo Seco)—May copper output 282,420 lb.

MANHATTAN (Murphys)—On San Domingo Creek; optioned to Mr. Greenburg and A. R. Folsom. Development in progress on the Hidden Treasure, lower mine of the group. Two shafts are being sunk. Vein about 4 ft. wide and 300 ft. long. Thomas J. Denslow, owner.

Del Norte County

CHROME DEPOSITS found on Cedar Creek, 17 miles south west of Waldo, Ore., by John Taggert.

DIAMOND CREEK CINNABAR (Crescent City)—Preparing to install machinery; L. C. Cole, owner, is in charge.

BRITTEN & WILSON (Waldo, Ore.)—Another rich vein of copper ore encountered at this mine, 17 miles south west of Waldo. J. N. Britten, manager.

COLD SPRING (Crescent City)—This chrome property, 25 miles northeast of Crescent City, under lease to M. A. Delano of Grants Pass, Ore., will begin shipping by steamer to San Francisco. Owned by G. W. Gravlin.

LUCKY BOY (Waldo, Ore.)—Leasers unable to proceed on account of lack of money. American Exploration Co. contemplates taking it over. Owned by Otto Anderson.

AMERICAN EXPLORATION CO. (Crescent City)—Chrome properties on French Hill and Low Divide, operated by this company, have 8000 tons of ore ready for shipment; five auto trucks expected for hauling ore to Crescent City; thence by steamer to San Francisco. Thomas Galvin, manager.

Eldorado County

BEEBE (Georgetown)—Sinking completed. Crosscutting on 250-ft. level.

GREEN CHROME MINE (Georgetown)—Extraction suspended, owing to lack of transportation; 250 tons ready for hauling to the railroad. Road repairs contemplated to Placerville. Property situated in Volcanoville section. Developed to depth of 200 ft. Owned by Warren Green.

Kern County

TEHACHAPI CINNABAR CO. (Marcel)—Development in progress and good ore reported; 10 men are employed.

MINNESOTA (Randsburg)—On north side of Rand Mountain; developed by 30-ft. tunnel and winze sunk on vein. Last ore from winze ran $27 per ton. East extension of the Yellow Aster. Robert Gunderson, owner.

Inyo County

TUNGSTEN development on Mt. Morgan, west of Round Valley, near Morgan Creek, by Cooper Shapley, has attracted attention of men who contemplate plant for mining and milling. Claims are owned by Beauregard, Vaughn and Stroud, and optioned by Mr. Shapley. Reported that examination will be made for Messrs. Close and McIntyre, of Los Angeles.

Nevada County

RED LEDGE (Washington)—Chrome shipments from this and other mines in Washington district attracting attention. Ore hauled by wagon to Nevada City and shipped by rail to Pittsburgh, Penn. No definite lens yet developed, but 150 tons of ore are in sight. Teams hauling ore return with lumber for the Ocean Star and Columbia mines; shipment of ores depends largely upon return freight for the ore wagons.

Placer County

EXCELSIOR (Forest Hill)—Pete Ferreria, reported to have confessed to high-grading $200 worth of gold, is under arrest. This is said to be the tenth case of high-grading from this mine within a month. When arrested Fereria was trying to dispose of $600 worth of gold dust.

Shasta County

AFTERTHOUGHT (Ingot)—The 300-ton flotation plant is nearing completion; expected to be in operation about middle of July. George L. Porter is manager.

REID (Redding)—Thirty miners at this gold mine in Old Diggins district walked out, demanding an increase all around of 50c. a day. Machine men are paid $3.50 per 9-hr. shift, muckers $2.75. Harvey Sallee, superintendent, was absent at the time.

San Bernardino County

SLATE RANGE (Randsburg)—This operation at "Benny Truman's camp," is employing 30 men. Regular shipments going to Salt Lake.

OSDICK, TREASURY AND SCHEELITE (Atolia)—These properties producing total of about one ton of placer tungsten a day.

LEONARD (Atolia)—Clarence Kirk leased block of claims west of the Churchill, one of the Atolia Mining Co. producing claims.

Siskiyou County

MANGANESE reported by Florian LeMay, on north fork of Greenhorn Creek. Several years ago manganese was reported at Red Rock point, which heads into Greenhorn. Prospectors going into the district.

Tuolumne County

DUTCH-SWEENEY-APP (Jamestown)—Ore from 2150 level is being treated in a portion of the old Dutch mill; 47 men employed. W. J. Loring, manager; C. H. Fry, superintendent.

ITALIAN CAMP (Sonora)—McCormick, Rolleri and others have given option on this low-grade group of claims situated near Phœnix Lake and development will begin on June 28.

TABLE MOUNTAIN MINING CO. (Tuolumne)—Incorporated for $1,000,000 with I. J. Lipsohn, M. Harrison, E. J. Doyle, G. F. Allen, M. A. Pickett as directors. Installation of equipment in progress. Mine formerly known as the Buckeye. Employing 14 men.

COLORADO

Boulder County

RED SIGN (Boulder)—Mill again in operation; treating both company and custom ores.

EUREKA (Boulder)—Four sets lessees working. Old dumps being jigged; good saving tungsten minerals.

CONSOLIDATED LEASING CO. (Boulder)—Reported will build mill in Eldorado section; custom ore to be treated. Now operating Swarthmore property.

Gunnison County

GOLD BELT (Pitkin)—Making good progress in driving tunnel.

SAW TOOTH (Gunnison)—In Beaver Creek district, 17 miles southwest. Installing compressor plant. Tunnel now in 1050 ft.

JOHNSON MOLYBDENUM (Pitkin)—Resumption of operations delayed by road blockade. Concentrates shipped from plant last season, and product now sold ahead. Chief molybdenum producer of state.

La Plata County

BESSIE (Durango)—Operations will be resumed at this property 17 miles northwest of Durango in La Plata Mountains. Considerable high-grade ore shipped last autumn.

Ouray County

GENESEE-VANDERBILT (Ironton)—Milling plant ready for operation. Property under lease to James M. Hyde.

San Juan County

SUNNYSIDE (Eureka)—Good progress being made in construction of new 500-ton mill.

GOLD KING (Gladstone)—Operating force will be increased and recent production doubled.

ZANG (Silverton)—Mine plant will be installed on this tungsten property. C. C. Eddy, manager.

DORA CONSOLIDATED (Silverton)—Examined recently for American Smelting & Refining Co.

HEMATITE LEASING (Silverton)—This company in Howardsville district has commenced shipping.

CARLSON (Silverton)—This group sold recently to R. E. L. Townsend and associates; work will start at once.

ELK (Gladstone)—Active development is to be resumed; several buildings erected and additional machinery installed. J. J. Custick, manager.

PRIDE OF THE WEST (Silverton)—New aerial tramway being erected to transport ore to the Green Mountain mill. A. W. Harrison, manager.

SAN JUAN CHIEF (Silverton)—Half interest in this mine on Engineer Mountain sold recently to Joseph Terry. Work will be started as soon as trails are opened.

LACKAWANA (Silverton)—Will be developed by the newly formed Lackawana Mining & Reduction Co. Last year developed bodies of lead, copper and silver ore.

BAGLEY TUNNEL (Silverton) — Formerly known as the Frisco; sold recently to Eastern men. Mill, bunk and boarding house built and development work under way.

SUMMIT (Silverton)—Will be worked by lessees. Good-grade copper-silver ore opened in five shallow shafts and crosscut tunnel, now in 600 ft., being driven to cut ledge at greater depth.

TELESCOPE (Ironton) — Will develop through main tunnel which now has a length of 1500 ft. Payable ore opened. Vein is 5 to 6 ft. wide. Compressor will be installed. C. B. Sheehan, manager.

San Miguel County

CARRIBEAU (Ophir) — New flotation equipment installed. George L. Bingham is manager.

SANTA CRUZ (Ophir)—Being developed by Clements Wichmann. Carload of ore, from development, shipped to smeltery at Durango recently.

SMUGGLER-UNION (Telluride)—Flotation plant completed and in successful operation. High saving being made. Walter Reed, superintendent.

ALTA (Telluride)—Fire June 17 caused damage estimated at $1000 to mill building. Heavy water pressure in fire lines saved building from complete destruction.

CARBONERO (Ophir)—George B. Pickett has secured five-year lease. Shoofly tunnel, now in 2700 ft., will be advanced. Installation of compressor and machine drills under consideration.

BUTTERFLY (Ophir) — Being developed by Jurich Mining and Leasing Co. Ten stamps dropping on ore recovered from old workings and from development. Ten additional stamps will be placed in commission as soon as water supply is sufficient.

Teller County

CAMP BIRD (Cripple Creek)—Electric driven compressor being installed by this leasing company on Rose Nicol.

TRAIL (Cripple Creek)—New oreshoot opened on 500-ft. level of this lease on United Gold Mines Co. ground.

CAROLINE (Victor)—Working Ajax mine. Station being cut on 1800-ft. level. Several sets of lessees producing ore.

GRANITE (Victor)—Sinking in Dillon shaft suspended until water, struck at 1775-ft. level, drains off through Roosevelt tunnel.

KOMAC (Cripple Creek)—Will take over lease on Victor mine, working through main shaft as soon as electric hoist is repaired.

VICTORY GOLD MINING (Cripple Creek)—This new company will take over the properties of the Albert Beacon Gold Mining Co., the Cripple Creek General and the Gold Camp Syndicate. Harry J. Newton, of Denver, is president and general manager; Frank Vetter general superintendent. Well-known mines included in the consolidation are the Prince Albert, Beacon and Eureka mines, on southeastern slope of Beacon Hill; the Little May, Katie Holis, Missouri, Placer and part of the Unexpected, on Newton Hill; and the Grouse, Humboldt, Emma Aimee, Josie S., and parts of the Bob Tail, Mud Hen and Leora V. claims. Part of these properties already under active development, and scope of operations will be enlarged. Low-grade ore available in old and new workings and on dumps, which it is now estimated can be profitably handled. Surface strike of 2-oz. ore, a rare occurrence in this district, was recently made by lessee on north end of Prince Albert ground.

IDAHO

Idaho County

UNITY GOLD MINES (Warren)—Tunnel at 1450 ft. cut the Banner vein, about 5 ft. wide; will continue to cut the Giant vein about 600 ft. beyond and the Charity mine about 3000 ft. farther which will be opened at 2000-ft. depth. Erecting 50-ton mill; hydro-electric power. R. A. Beall, superintendent; J. A. Csizek, consulting engineer.

MICHIGAN

Copper

HOUGHTON (Houghton)—Three drills in operation on sixth level; good rock taken out here and on eighth level.

AHMEEK (Calumet)—Has increased output to average established in March of 4200 to 4300 tons daily. Conglomerate openings have not disclosed especially rich rock.

HANCOCK (Hancock)—Sending slightly richer rock from deeper levels in Quincy No. 7 shaft to the Quincy mill. Output from both shafts about 900 tons daily.

ALLOUEZ (Calumet)—Sending about an average of 1750 tons daily, as compared with former 2000 tons. Two of the five locomotives installed and as soon as the five are in operation, increase in production is expected.

SENECA (Calumet)—Will not start sinking shaft until about middle of July. Equipment being moved to site, and work on spur of Keweenaw Central R.R. started. Negotiating for second-hand machinery in order not to delay operations.

TAMARACK (Calumet)—Sending only occasional shipment to Tamarack mills, most of product now going to Calumet & Hecla mills at Lake Linden. Increase in output anticipated shortly. Shafts will be equipped with larger skips.

FRANKLIN (Hancock)—Reopening No. 2 shaft as fast as possible to get into rich territory; opened by drifts from No. 1 shaft at depth of 2000 ft. Shaft badly choked by caveins at 14th and 15th levels. Production running as high as 1300 tons of rock daily.

CALUMET & HECLA (Calumet)—Steel up for addition, which will treble capacity of the distilling plant or "still house," at Lake Linden. This plant recovers ammonia used in the leaching process. Foundations for substation for power transmission and for big steel addition to coal docks completed; material on hand for the new office building. Calumet & Hecla sending 9300 to 9800 tons of rock a day to mills. The smaller C. & H. subsidiaries, such as Allouez, Superior, LaSalle and Centennial are still low in production, because of shortage of men. Allouez is making slight in-

crease since first of month, or 1600 tons daily, Centennial and Superior 500 tons each, and La Salle 600 tons.

Iron

BREITUNG IRON CO. (Marquette)—This Delaware corporation will be the holding company for the following Breitung properties. Mary Charlotte Mining Co., Breitung Hematite Mining Co.; Washington Iron Co.; Hopkins Mining Co.; a Minnesota corporation; Clifford Extension Iron Co. and the Breitung Iron Co., a Michigan corporation owning the Loon Lake Mining company, at Wilde, Ont. The new company has $15,000,000 common stock and $3,000,000 preferred, the latter is to be sold (1) to make cash payment of $501,000 on one of the properties, (2) to provide $1,000,000 working capital and (3) to retire bond issues of $600,000 each on the Mary Charlotte and the Breitung Hematite. Of the common stock, Edward N. Breitung holds $12,000,000 awarded for stock of subsidiaries.

MINNESOTA

Mesabi Range

STATE OF MINNESOTA has purchased the E. J. Longyear office building and sample warehouse at Hibbing and will use same as headquarters for the mining-inspection department on the Mesabi range. Price, $35,000. Warehouse will be remodeled into a chemical laboratory and changes made in office building.

BENNETT (Keewatin)—This Pickands Mather Co. property has let contract for additional buildings to Challberg & Baum, of Grand Rapids.

OLIVER IRON MINING (Hibbing)—Making preparations for opening Carson Lake mine, west of Hibbing; a state lease; underground operation.

SMITH (Hibbing)—Butler Bros. have two shovels at work in this pit loading ore; a state lease; shipping 10,000 to 12,000 tons a week to the docks.

ARTHUR (Hibbing)—This company has turned over all operating mines, not already leased, to the M. A. Hanna Co., of Cleveland. These mines include the Harold, Dale, South and North Ugo at Hibbing, Leonard at Chisholm, and the Thorne at Buhl. Contract calls for employment of all former workers.

INTERSTATE IRON CO. (Hibbing)—Has five diamond drills check-drilling the South Agnew property, preparatory to opening as an underground mine; one of the three new properties lately leased from Great Northern Ore Properties. Loading the stockpile at the Mississippi mine, Keewatin, and shipping ore from the Hill Annex pit, at Calumet, Minnesota, the two other new properties.

MISSOURI

Joplin District

GRAND CENTRAL (Joplin)—C. D. Fletcher opening this mine, worked 15 years ago. Sinking new shaft.

ST. JOE (Joplin)—Completing new 400-ton mill, just south of Picher, Okla. J. W. Grounds, Joplin, president.

VELIE (Miami, Okla.)—Completed first mill west of Picher, Okla., recently, and has now started construction on second. Frank Weeks, Joplin, intersected.

REPUBLIC (Tar River, Okla.)—Completed 250-ton mill on Wright land. Shaft down to 224 ft. with 40-ft. face of good ore developed. Company has leases on two other tracts.

POTOSI (Century, Okla.)—New 200-ton mill ready. Deep drilling has shown five ore levels, 65, 110, 135, 200 and 300 ft. T. F. Blunt, Potosi, Mo., president; W. H. Bust, manager.

ADMIRALTY ZINC (Century, Okla.)—Broke ground for fourth mill. Sinking three new shafts. Now using six shafts. Producing about 200 tons zinc and 100 tons lead concentrates weekly.

PATHFINDER (Joplin)—Planning 300-ton mill on lease southeast of new St. Louis camp in Oklahoma. Put down 18 drill holes; majority showed ore from 110 to 180 ft. George Glade and Adam Scott, Joplin, principals.

RAINBOW (Miami, Okla.)—Building 300-ton mill on leased Buffalo land, northwest of Quapaw. Two mill sites blocked out, and will start building No. 2 as soon as first is completed. Former Governor Haskell, of Muskogee, president.

BIG EIGHT (Baxter Springs, Kan.)—Developing mill site on Gilmore land in Oklahoma, just south of Baxter. Eight drill holes showed good run of ore beginning at 130 ft., with assays ranging from 6 to 15% blende. F. W. Braun, Galena, Kan., manager.

MONTANA

Lewis and Clark County

BARNES - KING DEVELOPMENT (Butte)—Increasing its forces at the properties in Marysville since the Butte strike started. Men who were getting $4.75 in Butte have gone to work in the Piegan-Gloster and Shannon gold mines for $3.50 per shift. Fine board and room, with modern accommodations, are obtainable in Marysville however for $1 per day, which would probably cost $2 per day in Butte.

Silver Bow County

STRIKE continues with practically all mines affected; working day shift only with about one-quarter of a normal crew.

TUOLUMNE (Butte)—This property which was closed down is again in operation on day shift with practically a full crew.

BUTTE & SUPERIOR (Butte)—Mill still in operation on June 28. No hoisting being done but some men are working underground.

NEVADA

Clark County

CONTACT (Goodsprings) — Important strike of zinc carbonate. Shipping three cars per month to Jean, 15 miles.

DAWN (Goodsprings) — Zinc carbonate in considerable quantity recently encountered. Will install hoist. A. Munzebruck, manager.

COPPER WORLD (Cima) — Machinery for new 100-ton copper smeltery practically all on ground. Expects plant to be operating in 30 days.

CHRISTMAS (Goodsprings)—Important strike of lead-silver ore of milling grade recently made in No. 3 tunnel, lowest working in mine. Expected that milling will be resumed.

ANCHOR (Goodsprings)—New compressor and hoist recently erected. Milling about 30 tons of lead ore daily; also ships crude lead and zinc ores. R. W. Moore, superintendent.

TAM O' SHANTER (Goodsprings)—Owned by John R. Newberry of Los Angeles. New hoisting plant will be erected at once. Shaft 300 ft. deep; will be sunk. Former producer of silver-lead ore.

PRAIRIE FLOWER (Goodspring)—At this property, which adjoins Yellow Pine on the north, new shaft down 200 ft.; crosscutting for ore zone. Recent discoveries in the north end of the Yellow Pine have important bearing on prospects. Compressor and Jackhamer drills installed. Old dumps being worked by hand jigs for lead content.

Esmeralda County

ATLANTA MINES CO. (Goldfield)—Regular shipments copper-gold ore being sent to smeltery. Low-grade ore, being blocked, will later be treated by flotation at Goldfield Consolidated mill.

NEVADA CO-OPERATIVE MINES CO. (Goldfield)—Operating old Empress mine on Gold Mountain, about 36 miles south of Goldfield. Several thousand feet of development done, exposing milling-grade ore.

Nye County

TONOPAH ORE PRODUCTION, for week ended June 23, was 9262 tons, valued at $166,716, comparing with 9117 tons for the previous week. Producers were: Tonopah Belmont, 2959 tons; Tonopah Mining, 1975; Tonopah Extension, 2380; Jim Butler, 650; West End, 854; Rescue, 254; Montana, 55; Cash Boy, 105; Monarch Pittsburgh, 60 tons.

WHITE CAPS EXTENSION (Manhattan)—Surface equipment being installed for prospecting ore-bearing limestone adjoining the White Caps. O. McCraney, superintendent.

White Pine County

NEVADA CONSOLIDATED (McGill)—May copper output 7,239,978 lb., comparing with 6,727,192 lb. in April and 7,723,148 lb. in May, last year.

CONSOLIDATED COPPERMINES (Kimberly)—Mill now treating over 500 tons daily; in 30 days this will be doubled; about 100 tons of direct smelting ores, averaging from 8 to 12% Cu, shipped daily. Underground development from Giroux shaft, in charge of Capt. Hogan, of Butte, showing up exceptionally well.

UNITED NEVADA (Ely)—From the Ward mine, as this property is generally known, 50 to 60 tons daily of ore averaging over $20, is being shipped. Hauled by contract in trucks; last three miles to mine heavy grade—from 6500 to 8000 ft. Leasers will immediately put in three-mile tramway to deliver 200 tons daily at bottom of hill. Ore is iron-silver-lead; valuable for fluxing. Mine is 18 miles south of Ely.

NEW MEXICO

COAL MINES of the Victor-American Fuel Co., near Gallup, McKinley County, purchased by Hayden, Stone & Co. for joint account of Ray Consolidated Copper Co., Chino Copper Co. and southwestern department of the American Smeltling and Refining Co. to assure a coal supply during coming winter. Consideration approximated $3,000,000. Gallup-American Coal Co. will be the title of the new company.

Grant County

CHINO (Santa Rita)—May copper output was 6,924,457 lb., comparing with 6,368,874 in April and 6,359,294 in May, last year.

AUSTIN-AMAZON COPPER (Silver City)—Cutting station at 200-ft. level, from which crosscut will be run to tap the large orebody opened at 100-ft. level. About 70 men employed.

UTAH

COAL SUPPLIES interfered with by damage to Denver & Rio Grande R.R., between Kyune and Helper, as result of breaking of Price River reservoir dam. Every effort being made to restore service to coal mines in Carbon and Emery counties so as to supply mining and smelting industries depending on this source of fuel. Expect to have single track restored through entire washed out area by July 11 to July 15.

Salt Lake County

UTAH COPPER (Garfield)—May copper output was 19,262,856 lb., comparing with 17,231,512 lb. in April and 15,950,215 in May last year.

Tooele County

INTERNATIONAL SMELTING (Tooele)—Dispatches of June 30 announce that the striking smeltermen decided to return to work by a vote 198 to 190. About 800 men were out. Sliding wage scale adopted.

CANADA

Ontario

TOUGH OAKES (Kirkland Lake)—Increased wages 50c. a day.

PETERSON LAKE (Cobalt)—Cut new vein 3 in. wide, carrying some silver.

SCHUMACHER (Schumacher) — Has closed down on account of labor shortage and high operating costs. Mill construction continued on second 150-ton unit.

VIPOND (Porcupine)—Stopped all underground work on account of labor shortage and high costs. Mill will be run on dump ore and on some broken ore in stopes.

McINTYRE (Schumacher) — Granted raise of 50c. a day. Development on 1200- and 1300-ft. levels highly satisfactory, vein being wider than on 1000-ft. levels and the grade higher.

DOME (South Porcupine)—Has granted increase of 50c. a day to its men, until cost of living approximates ante-bellum conditions. Mill is treating about 1300 tons a day; grade only about $3; ore all coming from the openpits so costs are low, being about $2.10 per ton.

HOLLINGER (Timmins)—In four weeks ended May 20, milled 35,337 tons averaging $7.49; gross profit, $92,809—less than 50% of the profit for the preceding period. Mill ran 65% of possible running time. Costs per ton milled were $4.66. Expended $87,809 on new construction. Deficit reduced to $81,375. Central shaft has been placed in operation and will be used exclusively for hoisting ore.

MEXICO

ESPERANZA (El Oro, Mex.)—Milled in April 22,724 tons—of higher grade than average of reserves. Estimated operating profit about $57,600.

TIGRE (Esqueda, Son.)—Reported that local government officials have taken over the operation of the Lucky Tiger mine, recently closed by the labor strike and enforced departure of American employees.

REAL DEL MONTE Y PACHUCA (Pachuca, Hidalgo)—Has accumulated sufficient supplies to run both mills at capacity. Good earnings expected for June as against deficits in preceding five months.

GREENE-CANANEA (Cananea, Son.)—Mines and reduction works continue closed, owing to difficulties with government officials arising out of company's refusal to pay taxes on relinquished claims and other trumped-up charges, and interference by local officials of the late state administration. Attitude of new administration, taking office July 1, not yet known.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver New York, Cents	Silver London, Pence	July	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
28	4.7540	78½	39⅞	2	4.7540	77⅞	....
29	4.7540	77⅞	39½	3	4.7540	77⅞	39½
30	4.7540	77⅞	39½	4	.....	...	....

New York quotations are as repoted by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

June July	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	29		11	11	8¼
28	@30	62	@11¼	@11¼	@9
	28¾		11	11	8¼
29	@29¼	62	@11¼	@11¼	@9
	28¾		11	11	8¼
30	@29¼	62	@11¼	@11¼	@9
	28¾		11	11	8¼
2	@29¼	62	@11¼	@11¼	@9
	28¾		11		8¼
3	@29¼	62	@11⅛	11	@9
4	...	....	.....	....	.....

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

June July	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
28	130	129½	142	245¾	240¾	30½	54
29	130	129½	142	244	238½	30½	54
30	...	...	...	...	...	...	...
2	130	129½	142	243½	237½	30½	54
3	130	129½	142	243½	238	30½	54
4	...	...	...	...	...	...	...

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

NEW YORK—July 3, 1917

Most of the metal markets came to a standstill this week, owing to continuance of the uncertainty as to what Washington is going to do with respect to business. Two large government orders—one for copper and one for zinc—were placed, but as for industrial business there were only one or two transactions for round lots in copper, and only a few in zinc. However, in lead a rather large business was done.

Copper, Tin, Lead and Zinc

Copper—At the beginning of the week, June-July copper was sold on the basis of 30c. net cash, New York. Third-quarter copper was to be had right through the week at 29¼c. There were sales of later deliveries, such as September-November and October-November at lower prices. The aggregate of the business was small.

The sale of copper to the government, which we reported last week, was for 60,000,000 lb. at 25c., time of delivery being indefinite, but extending nominally for 12 months. Contrary to some reports, the price was a firm bargain and is not subject to readjustment.

During April, refined copper to the amount of 2,446,960 lb. was exported from Baltimore to France; 10,741,144 lb. to England, 5,127,708 lb. to Italy and 2,240,068 lb. to Russia.

Copper Sheets—The price of copper sheets remains the same as quoted last week. We quote hot rolled at 39@40c. per lb., cold rolled 1c. higher. Wire still quoted nominally 35c. f.o.b. mill.

Tin—The market was very narrow, and the price for Straits tin was 62c. right through the week. Banka tin was quoted at 60c. The deliveries of tin during June were large, having been 3600 tons at Atlantic ports and 2798 tons at Pacific ports.

Belated cablegram from London quoted spot tin at £245¾ and futures at £240¾ for Wednesday, June 27.

Lead—A rather large business was done, chiefly for July delivery, the supply of which is evidently going to be larger than was expected a little while ago. In the St. Louis market business was done at 11 @11¼c., but the tonnage sold at the lower price was larger than at the higher. By the close of the week the premium over the price of the A. S. & R. Co. had all but disappeared.

Zinc—On June 28 some large business was done at about 8¼c., including one large block to a domestic consumer. Following these transactions, the volume of business was relatively small, and was at unchanged prices.

During the week the government bought, through the Zinc Committee, 23,250,000 lb. of high-grade spelter at 13½c., delivery extending through the next 10 months.

High-grade spelter is quoted at 13½c. and intermediate at 12c. Brass special is quoted at 9¼@10c. St. Louis, offers at 10c. failing to secure business.

Zinc dust is quoted at 16@17c.

It is reported that the new smelting works of the United Zinc Smelting Corporation, at Moundsville, W. Va., will be ready for operation this month.

The Société le Zinc des Pyrénées is operating a little plant of 1000-hp. at Fosdans, in the Pyrenees, for the treatment of local zinc ores by the Thierry electric furnace.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market continues quiet and without any new features of special interest. Quotations continue at about the same level. 59@61c. per lb. for No. 1 ingots at New York.

Antimony—This metal continued to be dull and was again a little weaker in tone. We quote spot at 18@19c. July-August shipments from China remain unchanged, however, at 15½c. c.i.f., New York, duty unpaid.

Bismuth—Quoted at $3@3.50 per lb.

Cadmium—Quoted at $1.50@1.75 per lb.

Cobalt—Quoted at $1.70 per lb.

Magnesium—Ingot is quoted at $2.50.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

Tungsten—The metal is quoted at $2.40 per lb.

Quicksilver—Market more active and stocks light; quotations being at $85, New York. San Francisco reports by telegraph, $83.50, active.

Gold, Silver and Platinum

Gold—Gold coin to the amount of $490,000 has been withdrawn from the New York subtreasury for shipment to Spain. The sum of $6,698,000 has been transferred to San Francisco on account of an equal shipment to Japan.

Silver—The demand for silver for the Far East market has been very good, but prices have not been maintained at the highest level reached, that is, 39¾ pence as supplies have been going forward quite freely. Shipments to London during the past week were about 600,000 ounces. The volume of business going in this direction has not been so large because the London price has not been able to attract the bullion and meet the freight and war rate differential as against the Pacific route.

The United States Treasury in May purchased 3,000,000 oz. of silver for coinage purposes. An extra amount of coins will be needed for payment of soldiers and sailors abroad.

It is stated in an official French report that, owing to the increasing demand for silver coins, the total mined in 1916 amounted to 154,283,813.50 francs in nominal value, representing a total 78.7% above that of 1915, and a weight of silver exceeding 20,700,000 fine oz. This coinage is applied to replace small paper notes in circulation.

Mexican dollars at New York, June 27, 61½c.; 28, 61½c.; 29, 61½c.; 30, 61½c.; July 2, 61½c.

Platinum—This market was a little weaker, business having been done at $102@104, which we quote for the week.

Our correspondent at Petrograd reports, under date of May 7, that the situation is generally without change. The total transactions for the last fortnight were not large. The demand has increased, especially by the jewelers. Prices varied widely. Small quantities have been sold in Petrograd at the price of 108,000 rubles per pood of crude platinum. The price reported last week was 105,000 rubles per pood.

Palladium—This metal was again stronger, sales having been made at $110, and at the close of the week there were reported to be buyers at $115. We quote $110@115 for the week.

Zinc and Lead Ore Markets

Platteville, Wis., June 30—Blende, basis 60% Zn, $75 for premium ore down to $70 for medium grade. Lead ore, basis 80% Pb, $130 per ton.

	Zinc	Lead	Sulphur
Week's shipment in tons.	3640	102	858
Year to date	70177	2949	13934
Corresponding period of last year	59858	2167	15000

Shipped during week to separating plants, 3777 of zinc ore.

Joplin, Mo., June 30—Blende, per ton, high $84.30; basis 60% Zn, premium $80@75; medium to low, $70@65; calamine per ton, basis 40% Zn, $40; average selling price, all grades of zinc, $71.04 per ton.

Lead, high $135.50; basis 80% Pb. $130@120; average selling price, all grades of lead, $120 per ton.

Shipments the week: Blende, 9899 tons, calamine, 1188 tons, lead, 1731 tons. Value, all ores the week, $994,640. Value, all ores six months, $23,347,660. Shipments six months: blende, 230,296 tons, calamine, 22,434 tons, lead, 41,255 tons. Increase over first half last year: blende, 50,288 tons, calamine, 8005 tons, lead, 10,393 tons.

Prices declined $5 per ton on all grades of zinc this week, after six weeks without change. Lead declined $15, recovering $5 today, closing at $120 basis. Each week one or more mills close in the sheet ground area on account of high cost of material and supplies.

Other Ores

Antimony Ore—Sales reported at $2.20 per unit.

Iron Ore—Prices, delivered lower Lake ports are for old-range bessemer, $5.95; old-range nonbessemer, $5.20; Mesabi bessemer, $5.70 and Mesabi nonbessemer, $5.05.

Manganese Ore—Prices have advanced, $1.05 per unit being reported paid for high grade metallurgical ore.

Molybdenum Ore — Small transactions were reported at $2.10 per lb. of molybdenum sulphide in concentrates assaying 90%.

Pyrites—Spanish lump quoted at 15c. per unit on basis on 10s. ocean freight, buyer to pay war risk, excess freight and any duty. Ocean freights from 35s. to 42s. 6d. Available domestic supply is light, since most of the supply is contracted for.

Tungsten Ore—The market was all but bare of supplies and consequently prices have stiffened materially. Spot wolframite of high grade realized $22, while scheelite sold at $25, basis of 60%, for both spot and forward deliveries, with buyers over. We quote the market firm at $22 for wolframite and $25 for scheelite.

Iron Trade Review

NEW YORK—July 2

Far from there being any deviation from the upward course of the pig-iron market, the prices each day are higher for practically every grade. There is no certainty over night what the next quotation will be for any brand of iron. The consumers are at a loss to determine a proper course to pursue.

PITTSBURGH—July 2

Opinion in the iron and steel trade is now rapidly swinging toward the idea that there will have to be some form of Government regulation as to prices or deliveries or perhaps both. While the opinion is far from general it is held by many who look the farthest ahead and who realize that the present prices, averaging in the neighborhood of $50 a ton above prices at which material is now being delivered, cannot be paid by the average consumer, and who realize also that deliveries on existing contracts must be delayed by the priority given to Government work and that if these delays are not properly apportioned the prosecution of the war will be interfered with.

The fixing of coal prices on June 28 at a reduction of about one-third has greatly encouraged the idea of regulation of steel prices, without much consideration being given to the important fact that the coal operators had nearly clear order books while the order books of steel mills are congested, yet with much Government buying in prospect. Regulation of deliveries therefore seems to be at least as important as regulation of prices.

The scrap market, always sensitive, declined a week ago as already reported and the lower prices have continued, being attributed to fear that finished steel price regulation will come and reduce the buying power of the mills. Pig iron has not declined, but on the whole has not stiffened. In billets and sheet bars the market is very narrow. In finished steel products transactions continue to decrease in volume, and prices are made by the few consumers who are specially positioned so as to be able to pay the very high prices to the few small mills that can still make deliveries in from three to six months. There is no regular market at all for forward delivery, say after six months, as the large mills will not sell and buyers are in no mood to contract. Apparently the whole iron and steel market is in chaos, but there is really good reason to believe that it is simply awaiting the new order of things to be developed either by the authority or at the suggestion of the Government.

Pig Iron—Some sales are reported at prices above those quoted a week ago but buyers on the whole are more timid on account of the high prices and the possibility of Government regulation, and the market as a whole can hardly be quoted above the figures of last week: Bessemer, $56@57.50; basic, $54@55; foundry and malleable, $53@55, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There is no general demand, while offerings are light. Middlemen are unwilling either to buy or to sell except for the earliest deliveries, fearing the price bubble may be punctured within a few weeks. The market is generally quoted at $95@100 for billets and $105@110 for sheet bars.

Coke

Connellsville—Heavy demand for spot furnace coke to make up for decreased contract shipments expected this week on account of the holiday, sent the market up to $15.50 in the closing days of last week, for P. R.R. or B. & O. equipment, P. & L. E. holding to $13@13.50. The previous maximum was $13, reached in February. Demand is now much lighter and the market will be nominal until after the holiday. Few of the contracts expiring June 30 have been renewed at a fixed price, the disposition being to arrange to continue shipments and name a price weekly in accordance with the spot market.

STOCK QUOTATIONS

N. Y. EXCH.†	July 2
Alaska Gold M	5⅛
Alaska Juneau	4⅛
Am.Sm.& Ref.,com.	106⅛
Am. Sm. & Ref., pf.	113⅛
Am. Sm. Sec., pf., A	99⅛
Am. Sm. Sec., pf. B	‡90
Am. Zinc	31⅞
Am. Zinc, pf	60
Anaconda	80⅜
Batopilas Min	.75
Bethlehem Steel	‡141⅛
Bethlehem Steel, pf.	‡120
Butte Superior	39⅛
Cerro de Pasco	85⅛
Chile Cop	21⅛
Chino	55⅛
Colo.Fuel & Iron	52⅛
Crucible Steel	89⅛
Dome Mines	11⅛
Federal M. & S.	14
Federal M. & S., pf.	42
Great Nor., ore ctf.	32
Greene Cananea	40
Gulf States Steel	128
Homestake	100⅛
Inspiration Con	61⅞
International Nickel	39⅜
Kennecott	44⅛
Lackawanna Steel	96⅛
Miami Copper	40⅜
Nat'l Lead, com.	56
National Lead, pf	109
Nev. Consol	23⅛
Ontario Min	5⅛
Quicksilver	1⅛
Quicksilver, pf	1⅛
Ray Con	28⅛
Republic I.& S.,com.	91⅛
Republic I. & S., pf.	102⅛
Sloss-Sheffield	58
Tennessee C. & C.	17⅛
U. S. Steel, com	128⅛
U. S. Steel, pf	117⅛
Utah Copper	109
Va. Iron C. & C.	70

N. Y. CURB†	July 2
Big Ledge	2⅛
Butte & N. Y	1⅛
Butte C. & Z	10⅛
Caledonia	.57
Calumet & Jerome	1⅛
Can. Cop. Corpn	2⅜
Carlisle	4⅛
Cashboy	.08
Con. Ariz. Sm.	2 1/16
Con. Coppermines	5⅛
Con. Nev.-Utah	1/16
Emma Con	1⅛
Ferber	.61
First Nat. Cop	3⅛
Goldfield Con	.52
Goldfield Merger	.06
Greenmonster	1
Hecla Min	9 1/16
Howe Sound	5⅛
Jerome Verde	1⅛
Joplin Ore & Spel	‡.15
Kerr Lake	4⅛
Magma	.46
Majestic	.40
McKinley-Dar-Sa	.47
Mohican	.75
Mother Lode	26⅛
N. Y. & Hond	‡12
Nipissing Mines	6⅛
Ohio Cop	1 1/16
Ray Hercules	4
Rochester Mines	.51
St. Joseph Lead	18⅛
Standard S. L	⅛
Stewart	1/16
Success	.37
Tonopah	6⅛
Tonopah Ex	2⅛
Tribullion	1/16
Troy Arizona	.28
United Cop	.81⅛
United Verde Ext	37⅛
United Zinc	4⅛
Utica Mines	.26
White Knob, pf	1⅛
White Oaks	‡2
Yukon Gold	1⅛

SAN FRAN.*	June 30
Alta	‡.03
Andes	‡.10
Best & Belcher	‡.01
Bullion	‡.02
Caledonia	‡.11
Challenge Con	‡.01
Confidence	‡.10
Con. Virginia	.28
Gould & Curry	‡.01
Hale & Norcross	.03
Jacket-Cr. Pt	‡.06
Mexican	.11
Occidental	‡.65
Ophir	.11
Overman	‡.04
Savage	‡.08
Seg Belcher	‡.02
Sierra Nevada	.14
Union Con	.18
Utah Con	‡.01
Belmont	4.15
Jim Butler	.80
MacNamara	.29
Midway	.09
Mont.-Tonopah	.23
North Star	.10
Rescue Eula	.21
West End Con	.68
Atlanta	.09
Booth	.07
Comb. Frac	.04
D'field Daisy	.03
Florence	.18
Jumbo Extension	.31
Kewanas	.13
Nevada Hills	.24
Nevada Packard	‡.34
Round Mountain	.40
Silver Pick	.11
White Caps	1.37½
Big Jim	.81½
United Eastern	4.12½

BOSTON EXCH.*	July 2
Adventure	2⅛
Ahmeek	98½
Algomah	.60
Allouez	62½
Ariz. Com., ctfs	14⅛
Arnold	‡.30
Bonanza	‡.20
Butte-Ballaklava	.58
Calumet & Ariz	79½
Calumet & Hecla	535⅛
Centennial	17
Copper Range	60⅛
Daly West	1⅛
Davis-Daly	5⅛
East Butte	12
Franklin	6⅛
Granby	81⅛
Hancock	14
Hedley	‡15
Helvetia	.25
Indiana	2
Isle Royale	31
Keweenaw	1⅛
Lake	11⅛
La Salle	3
Mason Valley	7⅛
Mass	13
Mayflower	2⅛
Michigan	2⅛
Mohawk	93
New Arcadian	2⅛
New Idria	14⅛
North Butte	17⅛
North Lake	1
Ojibway	1⅛
Old Dominion	59⅛
Osceola	86
Quincy	85⅛
St. Mary's M. L	‡81
Santa Fe	1
Seneca Mines	9⅛
Shannon	8
Shattuck-Ariz	‡27
So. Lake	3⅛
So. Utah	‡.25
Superior	8⅛
Superior & Bost	4⅛
Trinity	6⅛
Tuolumne	1
U. S. Smelting	60
U. S. Smelt'g, pf.	50⅛
Utah Apex	2⅛
Utah Con	15⅛
Utah Metal	4⅛
Victoria	3⅛
Winona	3⅛
Wolverine	44
Wyandot	.50

BOSTON CURB*	July 2
Alaska Mines Corp	.75
Bingham Mines	12⅞
Boston Ely	.42
Boston & Mont	.59
Butte & Lon'n Dev	.14
Calaveras	3⅛
Calumet-Corbin	01⅛
Chief Con	2⅛
Cortez	.20
Crown Reserve	.28
Crystal Cop	1⅛
Eagle & Blue Bell	2⅛
Houghton Copper	.95
Intermountain	1 1/16
Iron Cap, Com	16⅛
Iron Cap Con., pf.	16⅛
Mexican Metals	.28
Mines of America	1⅛
Mojave Tungsten	.44
Nat. Zinc & Lead	.65
Nevada-Douglas	1⅛
New Baltic	1⅛
New Cornelia	18⅛
Oneco	‡.50
Pacific Mines	.25
Rex Cons	.25

SALT LAKE*	June 29
Bannack	.00
Big Four	.53
Black Jack	.06
Cardiff	6.00
Colorado Mining	.20
Daly-Judge	‡8.50
Empire Copper	1.25
Gold Chain	.18
Grand Central	.68
Grand Gulch	.19
Iron Blossom	1.02½
Lower Mammoth	.03
May Day	.06½
Moscow	.12
Prince Con	1.15
Silver-King Coal'n	3.07½
Silver King Con	3.77½
Sioux Con	.11
So. Hecla	1.02½
Uncle Sam	.04
Wilbert	.19
Yankee	‡.10

TORONTO*	July 2
Bailey	.01
Beaver Con	.32
Buffalo Mines	1.25
Chambers Ferland	.10½
Coniagas	3.90
La Rose	.35
Peterson Lake	.11
Right of Way	.05
T. & Hudson Bay	‡38.00
Temiskaming	.37
Wettlaufer-Lor	.05½
Dome Exten	.06
Dome Lake	.14
Foley O'Brien	.60
Hollinger	4.09
Jupiter	‡.28
McIntyre	1.50
Newray	.40
Porcu. Crown	.48
Schumacher	.41
Vipond	.24
West Dome	.8

STOCK QUOTATIONS—Continued

COLO. SPRINGS	July 2
Cresson Con	5.12½
Doctor Jack Pot	.05
Elkton Con	.06½
El Paso	.30
Gold Sovereign	.04
Golden Cycle	2.16
Granite	.50
Isabella	.10
Mary McKinney	.16½
Portland	1.45
United Gold M	.20
Vindicator	.77

LONDON	June 15		
Alaska Mexican	£0	10s	0d
Alaska Tre'dwell	1	5	0
Burma Corp	4	3	9
Cam & Motor	0	8	6
Camp Bird	0	7	0
El Oro	0	10	0
Esperanza	0	11	0
Mexican Mines	4	7	6
Nechi, pfd	0	11	9
Oroville	0	16	3
Santa Gert'dis	0	10	0
Tomboy	0	19	3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024	76.971	23.267	31.060	39.035
July	47.519	62.940	.....	22.597	30.000	.....
August	47.163	66.083	.....	22.780	31.498	.....
September	48.680	68.515	.....	23.591	32.584	.....
October	49.385	67.855	.....	23.925	32.361	.....
November	51.714	71.604	.....	25.094	34.192	.....
December	54.971	75.765	.....	26.373	36.410	.....
Year	49.684	65.661	.....	23.675	31.315	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan	24.008	28.673	88.083	131.921	116.167	142.895
Feb	26.440	31.750	102.667	137.895	133.167	148.100
Mar	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	29.362	112.432	130.000	137.455	142.000
July	23.865	.....	95.119	.....	125.500	.....
Aug	26.120	.....	110.283	.....	126.304	.....
Sept	26.855	.....	113.905	.....	134.071	.....
Oct	27.193	.....	122.750	.....	142.523	.....
Nov	30.625	.....	134.659	.....	155.432	.....
Dec	31.890	.....	145.316	.....	162.842	.....
Year	27.202	.....	116.059	.....	138.281	.....

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231	62.053	179.466	242.083
July	38.510	.....	168.357	.....
August	38.565	.....	169.670	.....
September	38.830	.....	171.345	.....
October	41.241	.....	179.307	.....
November	44.109	.....	186.932	.....
December	42.635	.....	183.368	.....
Av year	43.480	.....	182.096	.....

Lead	New York		St Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936	11.171	6.749	11 123	31.011	30.500
July	6.352	.....	6.185	.....	28.137	.....
August	6.244	.....	6.088	.....	29.734	.....
September	6.810	.....	6.699	.....	30.786	.....
October	7.000	.....	6.898	.....	30.716	.....
November	7.042	.....	6.945	.....	30.500	.....
December	7.513	.....	7.405	.....	30.500	.....
Year	6.853	.....	6.777	.....	31.359	.....

Spelter	New York		St Louis		London	
	1916	1917	1916	1917	1916	1917
Jan	16.915	9.619	16.745	9.449	89.810	48.329
Feb	18.420	10.045	18.260	9.875	97.762	47.000
Mar	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	.....	8.755	.....	50.750	.....
Aug	8.730	.....	8.560	.....	51.587	.....
Sept	8.990	.....	8.820	.....	52.095	.....
Oct	9.829	.....	9.659	.....	54.159	.....
Nov	11.592	.....	11.422	.....	56.023	.....
Dec	10.665	.....	10.495	.....	55.842	.....
Year	12.804	.....	12.634	.....	72.071	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ‡ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	.....	18.95	.....	19.34	.....
July	21.95	.....	18.95	.....	19.20	.....
August	21.95	.....	18.95	.....	19.22	.....
September	22.88	.....	19.58	.....	19.53	.....
October	24.61	.....	21.26	.....	21.51	.....
November	30.07	.....	28.18	.....	26.55	.....
December	35.16	.....	30.95	.....	30.79	.....
Year	$23.88	.....	$20.98	.....	$21.15	.....

‡ As reported by W. P. Snyder & Co.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons if so requested.

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7379—LEACHING of Low-Grade Copper Ores. Joseph Irving. (Eng. and Min. Journ., May 26, 1917; 2 pp., illus.)

7380—PLUMAS COPPER BELT. G. H. Goodhue. (Eng. and Min. Journ., June 2, 1917; 1¾ pp., illus.)

7381—REPORTS AND ACCOUNTS—Standardization of Copper-Mining Companies' Reports, Accounts and Costs. T. O. McGrath. (Eng. and Min. Journ., May 26, 1917; 1 p.)

7382—SOUTH AMERICA—The Proposed Corocoro Mill, Bolivia. Mark R. Lamb. (Eng. and Min. Journ., June 16, 1917; 2 pp., illus.)

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7389—CALIFORNIA — Some California Mother Lode Mines. Lewis H. Eddy. (Eng. and Min. Journ., June 9, 1917; ¾ p.)

7390—CANADA—Manitoba As a Mining Province. J. A. Campbell. (Eng. and Min. Journ., June 23, 1917; 2½ pp., illus.)

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7392—NEVADA—The Belmont Camp, Nevada. Wilson W. Hughes. (Eng. and Min. Journ., June 9, 1917; 2 pp., illus.)

7393—ONTARIO—Kowkash Gold Area. P. E. Hopkins. (Report, Ont. Bureau of Mines, Vol. XXV, Part I, 1916; 10¼ pp., illus.)

7394—QUEENSLAND—The Mystery Bismuth, Gold and Silver Mine, Mount Langan, Near Blackbutt. W. E. Cameron. (Queensland Govt. Min. Journ., Apr. 14, 1917; 1 p.) 60c.

7395—RAND—Mining Problems on the Rand. H. Foster Bain. (Min. and Sci. Press, May 26, June 2, 1917; 11¼ pp., illus.) 40c.

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IRON ORE DEPOSITS MINING, ETC.

7398—CUBA—Geology of the Iron-Ore Deposits of the Firmeza District, Oriente Province, Cuba. Max Roesler. (Bull., A. I. M. E., May, 1917; 3 pp.) Author's reply to discussion. 40c.

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IRON AND STEEL—METALLURGY

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7407—CAST-IRON CORROSION — The Corrosion of Cast Iron and Its Bearing Upon the Electrolytic Theory of Corrosion. E. A. Richardson and L. T. Richardson. (Advanee copy, Am. Electrochem. Soc., May, 1917; 6 pp., illus.)

7408—CEMENTATION by Gas Under Pressure. F. C. Langenberg. (Advance copy, Iron and Steel Inst., May, 1917; 25 pp., illus.)

7409—CHEMICAL REACTIONS of Iron Smelting. Walther Mathesius. (Met. and Chem. Eng., June 1, 1917; 3¾ pp.) 40c.

7410—ELECTRIC FURNACE—Rennerfelt Electric Furnace Operation. C. H. vom Baur. (Advance copy, Am. Electrochem. Soc., May, 1917; 5 pp., illus.)

7411—ELECTRIC FURNACE—The Bethlehem 10-Ton Girod Steel Furnace. C. A. Buck. (Advance copy, Am. Electrochem. Soc., May, 1917; 5 pp.)

LEAD AND ZINC

7418 — HYDROMETALLURGY — Notes Upon the Hydrometallurgical and Electrolytic Treatment of Zinc Ore. E. E. Watts. (Met. and Chem. Eng., June 1, 1917; 1¾ pp.) 40c.

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